







13146/B

THE
ANATOMY, PHYSIOLOGY,
AND
DISEASES OF THE TEETH.



BY
THOMAS BELL, F.R.S., F.L.S., F.G.S.,
MEMBER OF THE ROYAL COLLEGE OF SURGEONS, IN LONDON, ETC.;
LECTURER ON THE ANATOMY AND DISEASES OF THE TEETH
AT GUY'S HOSPITAL, AND SURGEON-DENTIST TO
THAT INSTITUTION.

THIRD AMERICAN EDITION, WITH NUMEROUS PLATES.



PHILADELPHIA :
CAREY, LEA & BLANCHARD.
1837.



E. AND L. MERRIAM, PRINTERS,
WEST BROOKFIELD, MASS.

TO
MY FATHER,
THIS WORK
IS MOST AFFECTIONATELY
AND GRATEFULLY
Inscribed.

MY TALENTS

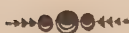
TO THE

JOINT STOCK COMPANY

OF THE

INDIAN

PREFACE.



THAT a practical work on the Anatomy and Diseases of the Teeth, founded upon the present improved state of our knowledge, both in physiological science and in the treatment of disease, is yet a desideratum in the medical literature of this country, is unequivocally evinced by the reiterated and universal complaints and inquiries, both of the students and practitioners of the medical profession. Neglected as the subject too generally is by the former class, during the period of their professional education, they no sooner find, in practice, the necessity of more extended information on the subject, than they seek in vain for books from which to derive that knowledge, the acquisition of which had been interfered with during their attendance upon the

classes, by other, and perhaps more essential objects of attention.

The very brief period to which the majority of students have, even up to the present day, been limited, for the study of all the really useful branches of medical education, contracted as it has been by a long waste of time in an apprenticeship, too often passed in the mere mechanical manipulation of the shop or the dispensary, has, of necessity, restricted them to the acquirement of those branches of knowledge which their examinations required. A better state of things is however in progress: the necessity of devoting a much longer period to the higher classes of medical instruction, is not only acknowledged by the profession, but officially recognised by the authorized sources of professional honors.

In addition however to the cause above-mentioned, of the dearth of information, on a subject confessedly of no trifling degree of interest, another, and that not less influential, is to be found in the unprofessional character of those persons, to whom the treatment of the teeth has

been too generally restricted, and the unmerited neglect which the subject has consequently received from the regular practitioners, to whose care, from their education and experience, the treatment of these organs would be more legitimately confided.

It is much to be regretted that the example of the great founder of physiological surgery, to whom the natural and pathological history of the teeth presented itself, as a subject of sufficient interest to occupy his especial attention, and whose acute and philosophical views, the lapse of more than half a century has only tended to confirm, should have been in this respect so little followed by his professed disciples; and that amidst the deserved and universal homage which has been paid to his discoveries—a homage the most honorable to the true philosopher, that of a conviction of the truth of his views, and the implicit adoption of his opinions, confirmed as they have been in so many instances by the results of subsequent investigation—his researches on the teeth should alone have been suffered to remain in comparative obscurity,

read by few, excepting those whom an exclusive devotion to the practice of dental surgery, more especially called to the study of that subject.

Amongst these, the ingenious and experimental Blake stands pre-eminent, as the worthy follower of his distinguished master. The hints of Hunter—and every one knows how important and how full of meaning those hints always were—served as the outlines of the plan in that field of investigation, in which Dr. Blake so efficiently labored. The errors of Hunter—and it is, I trust, no sacrilege to couple any mortal name with error—were discovered and corrected, his incongruities harmonized, and his opinions, after being submitted to the test of experiment and of rigid observation, either modestly rejected, or placed upon a still broader and more confirmed basis than before. The inaugural dissertation of Dr. Blake, enlarged and improved, as it subsequently was, must be considered as the best physiological treatise on the teeth which had at that period appeared; but the single circumstance of its being principally the production of his pupilage, whilst it increases our

estimation of the author's talents, is sufficient greatly to depreciate its authority as a practical work.

This deficiency was, however, in no small degree, supplied by the work of the late Mr. Fox, who had the merit of being the first English dentist who founded his treatment of the teeth upon a knowledge of the general principles of the profession, and combined the acquirements of a surgeon with the practice of his own peculiar department. His treatise on the natural history and diseases of the teeth, though very imperfect, and not free from other considerable faults, remains, to the present day, the best general practical work on the teeth in the English language.*

* In France, where every body writes, and so many write well, there are, as might be expected, numerous works on the treatment of the teeth, characterized by very various degrees of talent and utility. As I shall have occasion, in many parts of this work, to allude to some of the French writers, I shall refrain from entering into an examination of their merits in this place. It is sufficient here to observe, that if, on the one hand, many of them partake of the superficial and trifling character which has, perhaps illiberally, been so often assigned to that lively people; there are others which possess much of that originality of conception, and ingenuity of design, which may, with more justice, as well as with better feeling be attributed to them, as a bright trait in the literary and scientific character of their nation.

To attempt to correct the errors, and to supply the deficiencies of these works, and of others of less consequence, more recently produced—to place in the hands of the student, and of the medical practitioner, a plain and practical digest of the information at present possessed on the subject; and to lay before them the result of the author's own investigations and experience, is the object of the present work. That he has succeeded in this object to the full extent of his wishes, and given to his book that character of utility, at which alone his ambition prompts him to aim, he does not possess sufficient confidence to expect; but did he not anticipate the fulfilment, in some degree, of those intentions with which he entered upon its composition, he would not have felt himself justified in appearing before the public at all.

CONTENTS.



PART THE FIRST.

	Page
General View of the Structure of the teeth	3
Bone	4
Enamel	4
Chemical Composition	6
Organization and Vitality of the Teeth	9
Nerves and Blood-vessels.	20
The Number, Arrangement, and Uses of the Adult Teeth	25
The Incisores	25
The Cuspidatus	27
The Bicuspides	28
The Molares	29
General Remarks	31
Physiological Observations on the natural Food of Man deduced from the Characters of the Teeth	33
The Number, Arrangement, &c. of the Temporary Teeth	37
The Articulation of the Teeth	40
Description of the Alveolar Processes	41
Of the manner in which the Teeth are attached to the Alveoli	42
The Gum	43
Of the parts concerned in Mastication	45
The Temporo-maxillary Joint	45
Its Ligaments	47
The Muscles employed in Mastication	48
Of Mastication	49
Comparative View of the Motion of the lower Jaw in Infants and in old Persons	51
The Formation of the Teeth	53

	Page
Deposition of the Enamel	56
Enumeration of the Membranes of the Teeth	57
Formation of the Permanent Teeth	61
Progress of the Temporary Teeth	64
Observations on the Diseases which result from irritation of Dentition	67
Progress of the permanent Teeth	73
Shedding of the temporary Teeth	75
On the increase of the Maxillary Bones	80
Of Irregularity	82
Its prevention, and the Treatment of temporary irregularity	84
On permanent irregularity	93
Supernumerary Teeth	103
On the osseous union of Teeth	106
On the supposed occurrence of a third set of Teeth	110



PART THE SECOND.

General Observations on the Diseases of the Teeth	115
On Dental Gangrene (commonly called Caries)	118
Its Origin and Progress	118
Its Proximate Cause	122
Predisposing and remote Causes	128
Exciting Causes	130
The prevention of Dental Gangrene	136
Methods of Treatment	138
Cutting away the Diseased Part	139
Filling the Cavity	141
Tooth-ache produced by exposure of the Membrane	154
Observations on "Excision" of the Teeth	157
Gangrene of the Temporary Teeth	160
On Total Necrosis of the Teeth	164
Abscess in the Bony Structure	171
Exostosis of the teeth	173
On Injuries of the Teeth produced by Mechanical Violence	177
On the loss of Enamel, and wearing down of the Teeth	185
Of Salivary Calculus, or Tartar	192
Its Formation	193

	Page
Its Effects upon the Teeth, the Gums, and Alveolar Processes	196
Means of preventing its accumulation	198
Method of removing it	200
Diseases of the Internal Membrane	203
Abscess in the Cavity	203
Fungous growth of the Pulp	205
Diseases of the Gums and Alveolar Processes	207
Simple Absorption	209
Absorption with Swelling and Inflammation ("Scurvy")	210
Treatment	214
Alveolar Abscess	215
Tumors arising from the Gum and Alveolar Processes	230
Displacement of the Teeth by Alveolar Exostosis	241
The effects of Mercury upon the teeth, the Gums, and Alveolar Processes	244
Diseases of the Antrum Maxillare	249
Inflammation of the Membrane	251
Muco-purulent Secretion, or "Abscess"	253
Distention of the Antrum by accumulated Fluid	256
Treatment of "Abscess"	259
Caries of the Parietes	274
Tumors of the Antrum	279
On Extraction of the Teeth	286
The Accidents which may accompany or follow Extraction	303
On Neuralgia, and on certain Nervous affections connected with the Teeth	308
Constitutional Neuralgia	314
Local Neuralgia	321

PART THE FIRST.

THE
ANATOMY AND PHYSIOLOGY
OF
THE TEETH.

THE
ANATOMY AND PHYSIOLOGY
OF
THE TEETH.

GENERAL VIEW OF THE STRUCTURE OF THE TEETH.

THE teeth may, in the human subject, be defined as *distinct organs of a bony structure, attached to the maxillary bones, and formed for the purpose of dividing and comminuting the food, preparatory to digestion.*

Each tooth is anatomically divided into the body or crown,* and the fang or root.† The body must be considered as the essential part—the tooth properly so called—since it performs all the offices for which these organs are produced, as mastication, &c.; the root serves merely for its articulation with that portion of the maxillary bone in which it lies imbedded. The bodies of the teeth are of various forms, according to the particular office which each is destined to perform. The roots also, which are contained within the alveolar processes of the maxillary bone, vary in number, form, size, and relative position, in accordance with the degree of firmness

* Plate I. fig. 1, *a, a.*

† Ib. *b, b.*

which the various offices of the different teeth require. The part where the body and crown unite is termed the neck.*

There are two distinct substances which enter into the composition of the teeth, essentially differing from each other in structure as well as in chemical composition; the one being organized, the other crystalline. The first,† of which the mass of the tooth consists, is true BONE; the second, which, from its appearance, is called ENAMEL,‡ forms only a thin layer over the body of the tooth, to which part it is distinctly restricted.

The bony substance is of an extremely hard, dense structure; and, like other bones, is composed of an earthy and a cartilaginous portion. The earthy matter may be readily dissolved by immersion in dilute mineral acid; and the cartilage which remains, still retains its form, and is found to be more solid and compact than the same substance as it exists in other bones. The fracture of this bone is shining, and slightly conchoidal. On a minute examination, and particularly if aided by the application of heat, it is seen to consist of concentric layers, the disposition of which is parallel to the surface of the tooth. It is extremely indistructable; so much so, that on opening barrows and other ancient places of sepulture, the teeth are frequently found to have undergone scarcely any perceptible decomposition.

The enamel is an extremely hard, milky white, semitransparent substance, composed almost exclusively of earthy salts, principally phosphate of lime, containing a trace only of animal matter. It is the hardest of all animal substances, and con-

* Plate I. fig. 1, c, c.

† Ib. fig. 2, a, a.

‡ Ib. b, b.

sists of minute fibrous crystals, resembling in texture the fibrous carbonate or sulphate of lime;* they are disposed in a radiated direction with respect to the centre of the tooth; consequently the combined external extremities of the crystals form the surface, and the internal extremities are in contact with the bony substance, so that their sides are parallel with each other. The fibrous structure is very obvious when the enamel is broken, especially in the teeth of large animals, as may be distinctly seen in the grinding tooth of the elephant.† The great advantage of such an arrangement of the crystals as that just described, is, that in consequence of their united terminations being presented to the action of the food in mastication, the enamel is rendered less liable to injury from the effects of continual friction, and is also much less liable to accidental fracture. The result of an opposite arrangement in the disposition of the crystals, is obvious in graminivorous quadrupeds, in which, from the nature of their food, the teeth are continually wearing down, and a rough grinding surface is constantly required. In these animals the enamel dips down into the substance of the teeth, and is intermixed with the bone in regular vertical layers, so that the crystals, being placed parallel with the grinding surface of the teeth, instead of perpendicular to it, as in the human subject—their sides, instead of their terminations, are exposed to the friction of the food, and consequently, the enamel, as well as the bone, undergoes continual abrasion.

The enamel is thickest on those parts of the teeth which are most exposed to friction, as on the

* Plate I. fig. 3, 4.

† Ib. fig. 5, a, b.

horizontal surfaces of the grinders, the edges of the incisores, and the points of the cuspidati; becoming gradually thinner towards the neck, around which part it terminates almost imperceptibly. This distribution of the enamel may be shown by sawing through the crown of the tooth, and slightly burning the divided surface, by exposing it to the flame of a spirit-lamp; the animal matter of the bone thus becomes blackened, whilst the enamel retains its white appearance.

In the interior of every tooth is a cavity of considerable size,* which assumes the general form of the tooth itself, being larger in the crown, and gradually diminishing through the whole length of the root or roots, at the extremity of each of which it terminates in a minute foramen. This cavity is filled with a pulpy substance which is highly vascular and exquisitely sensible, and is closely attached to the parietes. The nerves and vessels which supply this structure enter the cavity through the foramen at the extremity of the root.† The roots are, externally, completely invested by periosteum, which terminates at the neck.

THE CHEMICAL COMPOSITION OF THE TEETH.

The analytical processes to which several celebrated chemists have submitted the teeth, have afforded results differing in some trifling circumstances from each other. It is a matter of very little practical importance whether the proportion of phosphate of lime to animal matter, or that of carbonate of lime to either, be one or two per cent. greater or less; but as a point of accuracy mere-

* Plate I. fig. 2, c, c.

† Ib. d, d.

ly, it may perhaps be desirable that our account be as nearly as correct as possible.

The following is the result given by Berzelius, whose analysis appears to have been more elaborate than that of any other chemist. It will be found to record the occurrence of several substances as existing in the enamel and bone of the teeth, the presence of which has not been detected by others. According to this celebrated chemist, the enamel of the adult teeth contains in 100 parts :—

Phosphate of lime	- - - -	85.3
Fluate of lime	- - - -	3.2
Carbonate of lime	- - - -	8.
Phosphate of magnesia	- -	1.5
Soda and muriate of soda	- -	1.
Animal matter and water	- -	1.
		<hr/>
		100.

The bony substance is stated, by the same authority, to contain :—

Phosphate of lime	- - - -	62.
Fluate of lime	- - - -	2.
Carbonate of lime	- - - -	5.5
Phosphate of magnesia	- -	1.
Soda and muriate of soda	- -	1.5
Gelatine and water	- - -	28.
		<hr/>
		100.

The following is a tabular view of the results obtained by Mr. Pepys, in his experiments instituted purposely for Mr. Fox's work :—

	Bone of Tempy. Teeth.	Bone of Adult Teeth.	Roots of Adult Teeth.	Enamel.
Phosphate of lime -	62	64	58	78
Carbonate of lime -	6	6	4	6
Cartilage - - -	20	20	28	0
Water and loss - -	12	10	10	16
	100	100	100	100

It appears from this statement, that not only fluuate of lime and the salts of magnesia and soda, of which Berzelius had found traces in his analysis, escaped the observation of Mr. Pepys, but also that he failed to detect the small quantity of gelatine, which the former author records as existing in the enamel. From the circumstance however of this substance becoming blackened, when exposed to considerable heat, it may be concluded, without a minute analysis, that it contains a small proportion of animal matter.

In consequence of a small proportion of fluuate of lime having been found in fossil teeth of animals, it appears that Mr. Brande instituted some experments, to ascertain whether this salt also existed in recent teeth, but did not succeed in detecting its presence. On this point however the testimony of Berzelius, quoted above, must doubtless be considered as conclusive. The existence of fluuate of lime in fossil teeth, would, perhaps, hardly be considered as sufficient to warrant an expectation of finding it in the recent structure; since in the former case it might be attributed to accidental deposition rather than to original formation.

ON THE
ORGANIZATION OF THE TEETH.

THAT the teeth possess vitality, that they are connected by their organization with the general system, having nerves, blood-vessels, and absorbents, and are analogous in this respect to other bones, is a truth so strongly attested by all the phenomena they present, whether in a healthy or a diseased state, that it is difficult to imagine upon what grounds it can have been controverted, or even doubted, by any one whose opinions are deduced from observation or experiment. The question is not whether in the internal cavity of a tooth nerves and blood-vessels exist, for this is too obvious to require proof; but whether these essential components of animal organization, do or do not enter into the composition of the substance of the tooth itself.

The conclusion which Mr. Hunter draws from his experiments and observations on this subject, is one which can only be accounted for by the extreme caution which he always observed in deducing general principles from isolated facts, and by the *apparent* incompatibility of different phenomena which were presented by him, arising from his having neglected, in the present instance, to *follow* out the reasoning to which they naturally gave rise. This conclusion he states in the follow-

ing terms :* “ From these experiments it would appear, that the teeth are extraneous bodies with respect to a circulation through their substance ; but they most certainly have a living principle, by which means they make part of the body, and are capable of uniting with any part of a living body :” and he afterwards distinctly acknowledges,† “ that a living tooth, when transplanted into some living part of an animal, will retain its life ; and the *vessels* of the animal shall communicate with the tooth.” How different is the modesty of this deduction, inconsistent as it may be, from the bold and hasty conclusion which some other physiologists have adopted, of the total absence of all vitality in these organs, merely from some trifling peculiarities in their phenomena, which however are not greater than the acknowledged differences of structure would warrant us in anticipating.

It has been often observed that the mode in which the teeth are produced, is so totally different from that of the formation of bone in general, as to lead to a reasonable doubt of the identity of their structure. It is however an interesting fact, that although this objection be true with regard to the original formation of a bone ; yet that a very striking analogy subsists between the production of the teeth, and that of bony matter deposited in exostosis. It is asserted, that, in this process, the bone is immediately secreted by the vessels of the periosteum, without the intervention of a cartilaginous matrix ; and it will be seen, when I come to describe the mode in which the teeth are formed, that the bony substance is secreted by an extreme-

* Nat. Hist. of the Teeth, p. 39.

† Page 231.

ly delicate membrane, called the proper membrane of the pulp, which is believed to be *a production of the periosteum of the alveolus*.

The obvious structure, as well as the chemical composition of the teeth, would lead to the conclusion that their constitution is similar to that of the bones in general. The existence of a proportion of animal matter so considerable as to retain the exact form of the tooth, with the exception of the enamel, after being steeped in dilute mineral acid till the earthy matters have been removed, appears on the face of it, a fact sufficiently conclusive ; for I know of no other instance of such a formation, in which the slightest doubt exists of the organization of the part.

The fang is covered by a periosteum, and the internal cavity also is lined by a highly nervous and vascular membrane ; both of these are intimately connected with the bony structure of the tooth. Now, unless we suppose that these membranes are the media by which vessels and nerves are sent to the bony substance of the tooth, and by which, in fact, its vitality is supported, and its connexion with the general system preserved ; it will be impossible to assign any purpose which can be answered by their existence. The presence of a vascular and nervous connexion between these membranes and the tooth, will appear the more probable, when it is considered that the adhesion between these parts is so strong as to require a slight degree of force to separate them ; which can only be accounted for by the presence of numerous vessels, &c., passing from the one to the other. We are therefore, I think, justified in considering this con-

nexion as identical with that which exists between the bones and their periosteum.

It is true, that, as Mr. Hunter and other authors object, the teeth have never been artificially injected, but this circumstance cannot be considered as conclusive against their vascularity, for we know that many other structures contain vessels adapted only, under ordinary circumstances, to the passage of the serous part of the blood; which vessels, under active inflammation, become so much enlarged as to convey the red particles also. The fact that the teeth are not *generally* tinged with red blood when in a state of inflammation, may be accounted for by the supposition that the bone is of so very dense a structure, as to prevent, in many cases, the slightest degree of distension of the vessels permeating its substance. I have, however, in many instances, on purposely breaking a tooth immediately after extraction, where the pain and inflammation had been severe, found *distinct red patches, in the very substance of the bone.*

Although no artificial injection of the teeth has ever been satisfactorily made, it is unfair to deny its possibility, for the coloring matter of all the injections hitherto employed, is composed of particles too gross to pass into vessels of such extreme tenuity, as those of the teeth must necessarily be; but what art has failed to effect, nature, or rather disease, has done for us; I have in my possession a set of teeth, from the head of a young woman who died of jaundice, every one of which is deeply tinged with a bright yellow color.

I have frequently examined the teeth of persons whose death has been occasioned by hanging or

drowning, and have invariably found the whole of the osseous part colored with a dull deep red, which could not possibly have been the case if these structures were devoid of a vascular system. In both instances the enamel remains wholly free from discoloration.

From the facts which I have now adduced, and many others might have been added, the vascularity of the teeth has, I trust, been satisfactorily proved, and perhaps it is sufficient to demonstrate the existence, in any structure, of any one of the essential component parts of animal organization, to prove that it is not destitute of the others. There are, however, some simple and incontrovertible facts, which prove distinctly the presence of nerves and of absorbents, independent of the argument derived from the existence of blood-vessels. It often happens that in consequence of the use of mercury, or from dyspeptic affections, the gum and the edge of the alveolar process recede from the neck of a tooth, which thus becomes exposed, and if this part be then touched with the point of any hard instrument, pain is immediately produced, which is always increased when the part is inflamed. It is obvious that the *periosteum* is not the seat of this pain; as that membrane is also absorbed to the same extent as the gum and alveolar process are lost, and the bone of the tooth is in all these cases absolutely denuded. In filing the teeth no pain whatever is produced until the enamel is removed; but the instant the file begins to act upon the bone, the sensation is exceedingly acute. The same circumstance frequently takes place when a portion of enamel is broken off by accident, and the bone exposed; the part still cover-

ed with enamel may be touched with impunity, but the slightest pressure upon the bone occasions an unpleasant and often painful sensation, the result certainly of the actual presence of nerves in the substance of the tooth itself.

The existence of absorbents in the teeth has been controverted by Hunter, on the ground of certain peculiar phenomena, which take place in them, in consequence of the introduction of madder into the circulation. The following is a statement of the result of his experiments. "But a more convincing proof," (he is arguing against their vascularity) "is reasoning from the analogy between them and other bones, when the animal has been fed with madder. Take a young animal, viz. a pig, and feed it with madder for three or four weeks; then kill the animal, and upon examination, you will find the following appearances: first, if this animal had some parts of its teeth formed before the feeding with madder, those parts will be known by their remaining of their natural color; but such parts of the teeth as were formed while the animal was taking the madder, will be found to be of a red color. This shows, that it is only those parts that were formed while the animal was taking the madder, that are dyed; for what were already formed will not be in the least tinged. This is different in all other bones; for we know that any part of a bone which is already formed, is capable of being dyed with madder, though not so fast as the part that is forming; therefore, as we know that all other bones when formed are vascular, and are thence susceptible of the dye, we may readily suppose that the teeth are not vascular, because they are not susceptible of it after being

once formed. But we shall carry this still farther ; if you feed a pig with madder for some time, and then leave it off for a considerable time before you kill the animal, you will find the above appearance still subsisting, with this addition that all the parts of the teeth which were formed, after leaving off feeding with madder, will be white. Here, then, in some teeth we shall have white, then red, and then, white again ; and so we shall have the red and the white colors alternately through the whole tooth. This experiment shows, that the tooth once tinged does not lose its color ; now as all other bones that have been once tinged lose their color in time, when the animal leaves off feeding with madder, (though very slowly,) and as that dye must be taken into the constitution by the absorbents, it would seem that the teeth are without absorbents as well as other vessels."

As it is not stated how long the latter experiments were continued, it would be difficult to say how far we may depend upon the result as affording a ground for so decided a conclusion ; but as it is confessed that even in the bones, absorption of the coloring matter proceeds but slowly, I should hesitate very much to grant its correctness, unless the details were more distinctly stated ; particularly when the extremely dense structure of the teeth is taken into consideration, which may naturally be expected to retard the absorption of the coloring matter, and to which, in short, may be referred all those apparently anomalous results, whether relating to circulation or absorption, which occasioned the doubts of this most acute and enlightened physiologist. In fact, no experiments have hitherto been made on the deposition and re-

moval of color, as regards the teeth, which can be considered perfectly satisfactory. Dr. Blake states, in his admirable work, that he was at that time employed in the experimental investigation of this subject, and that he intended publishing the result; but I am not aware of his ever having fulfilled that intention.

The question however does not rest upon doubtful experiment. A case which occurred to me some years since, the preparation of which is now in my possession, appears to me satisfactorily to prove the presence of absorbents in the teeth. It was, in fact, an instance of true abscess in the bone of a tooth. Inflammation had existed for a considerable time, and after extraction, on sawing the tooth through for the purpose of ascertaining the state of the internal structure, I found a cavity formed in the very substance of the tooth, communicating with the natural cavity, and filled with pus. Here then is a case in which suppuration had taken place, as a consequence of severe inflammation, and the pressure of the pus occasioned absorption.* The detail of this case will be found in a subsequent part of the work. My object in introducing it here, is to prove the actual existence of absorbent vessels in the teeth, independent of the argument in favor of their general organization.

I have now, I trust, sufficiently established the truth of the organization of the teeth. I have dwelt the longer on this subject, from a persuasion of its practical importance; for, unless this opinion be correct, my ideas on the diseases of these organs are wholly fallacious, and the mode of prac-

* Med. Chir. Trans. vol. x. p. 39. Plate II. fig. I.

tice which I shall have to recommend, founded altogether upon false data. Let it not be supposed that the opinions of physiologists are so universally with me on this point, as to render the investigation unnecessary. Such a supposition will cease, when I refer to the published notions of two celebrated men of the present day, the one a popular and learned French zoologist, the other a person no less influential as a physiological writer and lecturer in our own country. Mons. Blainville terms the bony substance of the tooth “la partie morte ;”^{*} and Mr. Lawrence, in a note appended to his excellent translation of Blumenbach’s Comparative Anatomy, has the following extraordinary passage : “The vascularity of the teeth is a doctrine refuted by every circumstance in the formation, structure, and diseases of these organs.”[†] Here then we are at issue.

Notwithstanding, however, the teeth appear to be, strictly speaking, organized, it must be remembered that they are possessed of a much lower degree of vitality than any other parts of the body. Unless this be granted, neither the results of the experiments already referred to, nor the peculiarities of their diseases, can be accounted for ; but grant their organization, and that this is *inferior in degree* to that of the other bones, and we shall perceive that the difficulties will be in a great measure, if not wholly, obviated.

^{*} Nouv. Dict. d’Hist. Nat., article “Dents.”

[†] P. 67, note (O.)

OF THE NERVES AND BLOOD-VESSELS WHICH SUPPLY
THE TEETH.

Having endeavored to establish the truth of the opinion, that the teeth are organized bodies, it remains to describe the vessels and nerves by means of which their organization is supported. An accurate knowledge not only of the nerves which are distributed to the teeth, but of all those branches which inosculate with them, as well as of the remote relations of these with the nerves of other parts of the body, would appear to be necessary in order correctly to understand the infinitely varying sympathetic affections, which are produced by the irritation of diseased teeth. It requires, however, but a moderate share of practical experience to be convinced, that however accurate and minute may be our anatomical knowledge of these parts, the affections to which I have alluded are, in some cases, so anomalous, and in others resemble so closely those which are the result of very different causes, that the same uncertainty which attaches to nervous disorders in general, is not less characteristic of those belonging to the nerves now under consideration. Still it must be allowed that, in a considerable proportion of these complaints, the diagnosis, and consequently the rational grounds of treatment, may be greatly elucidated by an acquaintance with the intricate connection which subsists between these various branches. At the first view which we take of the nerves of the face and neck, so complicated is their distribution, and so intricate their connexion with each other, that the task of reducing them to any thing like a simple and practical arrangement appears absolutely

hopeless, and hence we find that systematic writers on anatomy have generally contented themselves with a bare, uninteresting statement of the more obvious branches of each isolated nerve, and the parts to which they are finally distributed, without any attempt at a full and practical detail of their relations to each other, and the mutual dependance of their functions.

In the midst of these difficulties, the genius of one of our most distinguished physiologists has discovered the clue by which this labyrinth may be explored, and its mazes reduced to a consistent and intelligible plan. Mr. Charles Bell's theory of the different classes of nerves, and of the distinct office to which they are respectively assigned, may rank among the most brilliant discoveries, not of his own time only, but of almost any former age; and it is impossible to conjecture to what important results it may lead, or what influence the facts which he has established may ultimately have upon the knowledge and treatment of disease. The nerves from which the teeth derive their sensibility have, in an especial manner, been elucidated by the experiments of this gentleman; and the identity of structure and character, which he has shown to exist between the fifth pair and the spinal nerves, is calculated to remove much of the obscurity in which their functions had previously been shrouded.

The fifth pair of nerves, which, according to Mr. Charles Bell's views, consists of two distinct parts, a sensitive and a *motor* portion, is the grand medium of sensation to the head and face. Its sensitive part leaves the semilunar ganglion in three great branches—the ophthalmic, the superior max-

illary, and the inferior maxillary. There is a fasciculus which passes by the ganglion, and unites with the third division, constituting according to the author I have just been citing, the true *motor* portion of this nerve.

It is not my intention to occupy any unnecessary space, in tracing minutely the course of these nerves and that of their branches, as I conceive that my object will be better attained by attending to their general distribution, with a view to the character of their functions, than by entering into a dry detail of the route which they take towards their destination, especially as the latter object is amply provided for, in all the systematic works on anatomy. And even with regard to this object, I propose to give a sketch only of what appears to me to be a correct and practical view of the nerves of these parts, referring, for a more enlarged description, to the works of the distinguished writer to whom I have just alluded, and of whose labors I shall avail myself as I proceed.

The first division, or OPTHALMIC nerve, divides into three branches, of which the first, called the *frontal*, is distributed to the frontal sinus, the orbicularis muscle of the eyelids, the frontal muscle, &c., and the integuments of the forehead, in which distribution its branches communicate with those of the portio dura. The second, or NASAL branch, supplies the caruncula lacrymalis, the lachrymal sac, part of the frontal sinus, and is ultimately distributed to the pituitary membrane and *alæ nasi*. To the membrane of the nose it communicates common sensation, as the olfactory nerve affords the particular sense of that organ. In these several terminations, it communicates with branches of the

second division, or superior maxillary. A twig is also given off, to form, in conjunction with a branch of the third pair, the lenticular ganglion, which gives origin to the ciliary nerves. The third, or lachrymal branch of the ophthalmic nerve, supplies the lachrymal gland, sends branches to the tunica conjunctiva, and communicates with branches of the superior maxillary nerve and portio dura.

The second division possesses a still closer interest, from its more immediate connexion with our subject, as its branches supply the whole of the teeth of the upper jaw. The SUPERIOR MAXILLARY NERVE, after distributing small branches to the orbit, the skin of the temple, and of the cheek, gives off the *spheno-palatine*, the *vidian*, the *palatine*, and the *alveolar*, whilst the trunk is continued under the name of infra-orbital. The vidian nerve is one of considerable consequence, as it forms the means of communication by its deep-seated branch, with the great sympathetic nerve. This intimate connexion with the great medium of sympathy between all the principal organs of the body, cannot but be considered as highly important in accounting for the various remote sympathies which occur in relation to the teeth, and must not be lost sight of when we enter upon the consideration of those affections in a future part of the work. The palatine branch is distributed to the palate, the membrane of the mouth, and the gum, besides small branches to the nose; and others to the tonsils, &c. The ALVEOLAR branch of the superior maxillary, after giving branches to the cheek and buccinator muscles, enters the maxillary bone by small twigs through the little foramina in the tubercle, and supplies the whole of the superior molares. The trunk

of the nerve, assuming now the name of *infra-orbital*, passes through the canal of that name, and whilst in its passage, gives off the branches which supply the incisores, cuspidatus, and bicuspides, after which it emerges through the infra-orbitary foramen, and is spread out upon the cheek, constituting the principal sensitive nerve of that part of the face.

The third division of the fifth pair, THE INFERIOR MAXILLARY NERVE, after distributing small branches to the neighboring muscles, &c., divides into two important nerves. The first is the gustatory, or nerve of the sense of taste; the second, the proper inferior maxillary nerve. The manner in which the communication takes place between the gustatory nerve and the *portio dura* of the seventh pair, does not appear to be well ascertained whether by a branch of the latter (termed *chorda tympani*) joining the gustatory nerve, or whether, as Mr. Charles Bell has suggested, "a branch of this nerve, (the gustatory) by traversing the petrous of the temporal bone in a retrograde direction, unites itself with the *portio dura* of the seventh pair." The latter opinion appears to me to be confirmed by the following consideration: granting that the *portio dura* is *simply* a nerve of motion, as Mr. Charles Bell has proved, if the *chorda tympani* were a branch derived from that nerve, it could not be the means of communicating sensation, but we find that in case of irritation in the molares of the lower jaw, especially in the *dens sapientiæ*, the pain is referred to the ear exactly in the direction, in fact, of the *chorda tympani*; a circumstance which is perfectly intelligible, supposing this branch

to be derived from the third part of the fifth, *a true sensitive nerve*.

The trunk of the inferior maxillary nerve, entering the posterior maxillary foramen, passes through the whole length of the canal, giving branches to all the teeth under which its course lies : arrived at the mental foramen, it sends a branch forward to supply the incisores, and, emerging upon the skin, is distributed to the integuments and muscles of the neighboring parts.

The hasty sketch even, which I have here given of the distribution of the fifth pair of nerves, simplified as it is by the rejection of all sensitive sympathy with the motor nerves of the face, is sufficiently complicated and extensive to illustrate the variety of those affections to which I have already alluded. In the farther consideration of those affections, the practical intention of these remarks will be sufficiently apparent. It is sufficient here to observe, that not only the whole of the face and neighboring parts must be considered as subject to those sympathies, but the more important organs of the body also, by means which the foregoing view of the nerves will render perfectly intelligible, are not exempt from morbid impressions, produced by the same cause, and conveyed by the intimate, though distant connexion which subsists between the fifth pair and the great sympathetic system.

The arteries which supply both the upper and lower jaw, and which transmit branches to the teeth, have their origin from the *internal maxillary* branch of the EXTERNAL CAROTID. This vessel, after giving off small branches to the ear, and the spheno-spinal artery to be distributed to the

dura mater, parts with the inferior maxillary branch, which passes downwards between the pterygoid muscles, to the posterior maxillary foramen. In its course through the canal of the lower jaw, it sends branches to every tooth beneath which it takes its course, and sending forwards others to the incisores, it emerges from the bone at the mental foramen, and is ultimately distributed to the chin and lips, where it anastomoses freely with the branches of the facial.

The upper teeth receive their supply of blood from two branches. The molares from the *alveolar* or *superior maxillary*, which, taking its rise behind the antrum, enters the posterior part of the bone, by the foramina of its tubercle, and its branches are distributed to the three molar teeth, to the posterior part of the membrane of the antrum, and to the substance of the bone. The infra-orbital branch arising behind the orbit, passes through the infra-orbital canal, sending branches, in its course, to the bicuspides, cuspidatus, and incisores, as well as to the antrum maxillare and adjacent parts. It makes its exit at the sub-orbital foramen, and finally ramifies over the cheek, where it also communicates with branches of the facial artery.

The veins by which the blood is returned from these parts, after following the course of the corresponding arteries, form the internal maxillary vein which terminates in the external jugular.

THE
NUMBER, ARRANGEMENT, AND USES
OF THE ADULT TEETH.

THE total number of teeth in the adult is thirty-two. Mr. Hunter* speaks of considerable variations in this respect, arising, as he says, from the occasional absence of the last grinder above or below, on one or both sides. There is, however, every reason to believe that this tooth is as constantly formed in the jaw as the others, and still more so than some to which I shall hereafter refer; but in the cases related by him, they probably had not yet made their appearance; as I have known them, in some instances, come through the gums as late as sixty years of age. The teeth are arranged in perfect uniformity in each jaw, eight on each side of the symphysis of the lower, and of the maxillary suture in the upper, those of one side exactly corresponding with those of the opposite. They are divided into four distinct classes; namely, on each side of either jaw two incisores, one cuspidatus, two bicuspidates, and three molares; and these classes differ from each other in size, form, articulation, and use.

OF THE INCISORES.†

The incisores, or cutting teeth, are situated in

* Nat. Hist. of the Teeth, p. 47.

† Pl. II, fig. 1, 2, 3, 4, a, a, b, b.

the anterior part of the jaw, forming the centre of the maxillary arch. Each has but one root. The body of an incisor, viewed laterally, is wedge-shaped; it has an anterior and posterior flattened surface, which converge and form a cutting edge at the extremity. The anterior surface is somewhat convex, and perpendicular to the edge of the alveolus; the posterior more or less concave, but with the concavity interrupted by a projecting tubercle, and sloping forwards from the neck to the edge. In a front view, the edge is the broadest part: it decreases in breadth towards the neck, and continues tapering to the extremity of the root. But laterally, the cutting edge is of course the thinnest, from whence it enlarges to the neck, and then again becomes gradually smaller. Thus the form of this tooth, viewed in front, is that of a simple wedge; whereas its lateral aspect gives the form of two wedges, of different lengths, united at their bases. The roots of the incisores of the lower jaw are flattened laterally. The general length of the whole tooth is from three quarters of an inch to an inch and an eighth. The enamel is continued farther down, and is also thicker on the anterior and posterior surfaces than at the sides, where its boundary forms an arched line. In the upper jaw, the central incisor is considerably larger than the lateral; in the lower, the contrary is the case, though in a trifling degree, and the latter are altogether much smaller than the former. The superior central incisor is rather more rounded at the part in contact with its fellow, than at the opposite corner; and the lateral is considerably less angular on the side next to the cuspidatus.

The use of the incisores is, as their name im-

ports, simply to cut the food, which they do on the principle of shears, or scissors.

OF THE CUSPIDATUS.*

The cuspidatus stands next to the lateral incisor. Its shape is somewhat like a superior central incisor, with the angles ground off; but it is thicker, more convex anteriorly, and less hollowed behind. Its principal projection is at the side next the incisor; the opposite side being rounded off with a considerable degree of obliquity. The enamel descends farther down on the sides than in the incisores; the root is also larger than in these. It is the longest of all the teeth; and is not only flattened laterally, like that of a lateral incisor, but is slightly grooved on each side from the neck to the extremity, forming the first step towards a division into more than one root. The body of an inferior cuspidatus is longer and less gibbous, and its sides more nearly parallel than the superior. "The use of the cuspidati," says Mr. Hunter,† "would seem to be, to lay hold of substances, perhaps even living animals." This opinion, however, can scarcely be considered correct as applied to these teeth in man; for as the endowment of reason, and the possession of the convenience of hands, makes such a mode of obtaining food unnecessary, whilst his naturally erect posture renders it absolutely impracticable; it would be much more rational, as well as more consonant with their form and situation, to consider them as intended for the purpose of tearing such portions of food, as are too hard to be readily divided by the incisores.

* Pl. II. fig. 1, 2, 3, 4, c, c.

† Nat. Hist. p. 5.

OF THE BICUSPIDES.*

These teeth, which constitute the class next in order to the cuspidatus, were formerly termed the small grinders ; but as this is not the only use for which they are naturally destined, Mr. Hunter more correctly denominated them bicuspidates, from their being furnished with two distinct prominences, or points. There are two of these teeth on each side. The first is often a little smaller than the second, and has rather a larger root, approaching somewhat nearer the form of the cuspidatus ; but in other respects they are so similar, that a general description will be sufficient for both. The bicuspidates are thicker than any of the teeth before mentioned, from the external to the internal surface, but considerably flatter at the sides. The body terminates in two points, one external, the other internal, the former being the larger and more prominent ; so that, on looking at that part horizontally, one of the points only is visible, and little difference is observed between this tooth and the cuspidatus. In the lower jaw, the internal point is so small as to constitute merely a slight prominence. The thickest part of the tooth, from side to side, is where these conical prominences unite, and from thence it decreases to the extremity of the root ; but in the other direction it continues broad to nearly the end of the root, is still more grooved than the cuspidatus, and often terminates in two distinct points, having the appearance of two roots partially united. These characters are more obvious in the second than in the first bicuspid, and in the upper than in the lower jaw ; those

* Pl. II. fig. 1, 2, 3, 4, d, d, e, e.

of the upper are also considerably the largest. The enamel terminates in a more equal line around these teeth, than in the incisores and cuspidatus. Their use, judging from their conformation, appears to be to assist, in some measure, in mastication, but more particularly to tear tough substances, preparatory to their more perfect trituration by the molares : they may therefore be said to partake of the different offices of the molares and cuspidati.

OF THE MOLARES.

There are three molares on each side. The third, which has received the name of *dens sapientiæ*, from the late period at which it makes its appearance, differs in so many particulars from the others, as to render a separate description necessary. The first and second molares* are the largest of the teeth. There are four or five prominences on the grinding surface, with corresponding depressions ; and these are so arranged, that the elevations or tubercles of those in the upper jaw are adapted to the concavities of those of the lower, and vice versa. The enamel is continued in an almost even line round the necks of these teeth, and is much thicker on the grinding surface than at the sides. In the upper jaw the molares have three roots, in a very few instances four, and I have once seen five ; in the lower there are only two. Of the three roots of the upper molares, two are situated externally almost parallel with each other, and are placed perpendicularly ; the third, which forms an acute angle with the others, is directed towards the palate. The bodies of the molares of the upper jaw are all more or less of a rhomboidal

* Pl. II. fig. 1, 2, 3, 4, *f*, *f*, *g*, *g*.

figure; those of the lower are nearly rectangular. Of the two roots of the lower molares, one is anterior, the other posterior: they are nearly straight and parallel with each other, and are much flattened laterally. They are considerably broader than those of the upper jaw. The divergence of the palatine root of the superior molares not only renders these teeth more firm in their situation, but also allows more room for the floor of the antrum maxillare; for were they all to be placed perpendicularly in the jaw, either they must have been considerably shorter, or the antrum less capacious; otherwise they would, in all instances, as is, in fact, now and then the case, protrude into that cavity. That this is the principal object of such a construction, may be inferred from the fact, that the teeth of the upper jaw correspond with those of the lower in the number and arrangement of their roots, *excepting these two*; and the superior dens sapientiæ, which is placed under the back part of the antrum, generally has all the roots directed backwards, so as more completely to avoid it.

The third molaris,* is rather shorter and smaller than the others; its form is less angular, and the roots are very differently constructed. There is sometimes a single root only, of a conical form, and this is usually the case in the lower jaw; in the upper there are frequently three, four, or even five, though these are occasionally so united as to form, in effect, but one. From these circumstances it follows that they have considerably less hold of the jaw than the other molares, except when the roots are very much curved, a deviation from the natural form not at all unfrequent in these teeth.

* Pl. II. fig: 1, 2, 3, 4, h, h.

REMARKS.

A few general observations naturally arise from the account which has been given of the separate classes of the teeth. There is obviously a regular gradation in size, form, and use, through the whole series, from the incisores to the molares. Thus the cuspidatus holds a middle place between the incisores and bicuspidates, which are in every respect intermediate between the cuspidatus and the molares. The incisores are formed for cutting the food only; the cuspidatus for tearing it; the bicuspidates partly for tearing and partly for masticating; and the molares solely for the purpose of trituration. The incisores again have but one root, nearly round and perfectly simple; the body is flat and has a cutting edge. The cuspidatus has also only one root, but it is somewhat flattened, and even partially grooved; the body is rounded, with a conical point at its apex. The bicuspidates have each but a single root, but this is often divided at its extremity, and is so much grooved as to have the appearance of two fangs partially united; the body has two points instead of one, approaching thus to the form of the molares. These last have always two, sometimes three roots, the body is increased in size, and has a complete grinding surface.

From the incisores to the first molares, the bodies of the teeth increase in thickness, and they become somewhat less from the first to the last molares.

On viewing the teeth of the upper and lower jaws, in their natural relative situation when the mouth is closed, it will be seen that the superior

incisores and cuspidati project a little beyond the inferior, and extend over a small part of the edges of the latter, so as partially to conceal them.* It will also be observed, that in consequence of the larger size of these teeth in the upper than in the lower jaw, the corresponding teeth do not accurately meet each other.† Thus the superior central incisor occupies a space equal to that of the inferior central and half the lateral incisor. The superior lateral incisor extends over rather more than half the inferior cuspidatus; the superior cuspidatus reaches as far as half the first inferior bicuspis; the first superior bicuspis to half the second inferior; the second superior bicuspis to about a third part of the first inferior molaris; the first superior molaris extends over a small portion of the second inferior, and the second superior molaris infringes a little upon the inferior dens sapientiæ; but in consequence of this last tooth being in general rather larger than its antagonist the two dentes sapientiæ are accurately adapted to each other, and thus the upper and lower series terminate together. The importance of this arrangement will be seen in the additional security which is thus obtained by a division of the pressure in mastication.

* Plate III. fig. 1, 2.

† Ib.

PHYSIOLOGICAL OBSERVATIONS

ON

THE NATURAL FOOD OF MAN

DEDUCED FROM THE CHARACTERS OF THE TEETH.

FROM the foregoing view of the nature and offices of the different classes of the teeth, it appears that their structure and uses are more perfectly equalized in the human subject, than in any other animal. It is true that, in some tribes of animals, whose habits require the greatest possible extension of the office of a particular class of teeth, a corresponding development of that class is found to take place, to a much greater degree than in man. Thus, in the *carnivora*, the *cuspidati* are greatly elongated and strengthened, in order to enable them to seize their food, and to tear it in pieces; in the *rodentia*, or gnawing animals, as in the beaver for instance, the *incisores* are remarkably long and exhibit that extraordinary development which their peculiar habits demand; and, in the *graminivorous* animals, the *ruminantia* especially, the *molaes* are found to occupy the most conspicuous situation. But, in each of these instances, the other kinds of teeth are found to be proportionally of less importance, and in some cases are actually wanting. In man, on the contrary, every class ap-

pears to be equally developed, to a moderate, though a sufficient degree, and to exhibit a perfection of structure, which may be considered as the true type, from which all other forms are mere deviations. It becomes, therefore, a question of some interest, and perhaps of no less difficulty, to what food the structure which has just been demonstrated is particularly adapted. The opinion which I venture to give has not been hastily formed, nor without, what appeared to me, sufficient grounds; I advance it, however, with diffidence, and do not profess to consider it as much more than hypothetical.

The endowment of reason, that greatest, best gift of the Creator, appears, if we consider the perfection of human organization, to be particularly, and, in its highest degree, even exclusively, adapted to the confirmation and requirements of man. This high and divine endowment should never be lost sight of in our reasonings on the human structure, and the physiology and habits of our species; as it is only with the allowances and modifications, which the possession of a quality so infinitely higher than the instinct of other animals necessarily supposes, that the actual habits of man can be viewed as compatible with his organization. Although these habits,—now essentially arising from, and combined with, a state of civilization, which, in a greater or less degree, must be allowed to exist in every known tribe of our species,—cannot be considered, in any one instance, as actually and exclusively *natural*; yet we may be led, by a careful examination of the structure of the different organs, and by an analogical comparison of them as they

exist in man, with the same organs in those animals which most nearly resemble him in structure, but which are still found in a perfectly natural state, to a plausible supposition, at least of what were originally his natural habits; and which would have still continued so, but for those changes which have arisen from the possession of this very endowment.

With this view of the subject, it is not, I think, going too far to say, that every fact connected with the human organization goes to prove, that man was originally formed a frugivorous animal, and therefore, probably tropical, or nearly so, with regard to his geographical situation. This opinion is principally derived from the formation of his teeth and digestive organs, as well as from the character of his skin, and the general structure of his limbs. It is not my intention now to go further, into the discussion of this subject, than to observe, that if analogy be allowed to have any weight in the argument, it is wholly on that side of the question which I have just taken. Those animals, whose teeth and digestive apparatus most nearly resemble our own, namely, the apes and monkeys, are undoubtedly frugivorous; but as, from their organization, they are necessarily tropical animals, and without the gift of reason, by which they might have overcome the difference of temperature by artificial means, they remain still restricted to their original food, and confined to the very limited climate to which their structure peculiarly adapted them. The reasoning powers of man, on the contrary, have enabled him to set climate at defiance, and have rendered him, in all cases, more or less an artificial being. No longer restrained within

that range of temperature to which the delicacy of his frame, no less than the nature of his original nutriment would have confined him, he becomes the denizen of every climate, and the lord of terrestrial recreation.

OF THE TEMPORARY TEETH.

AT an early period of infancy, indications are given, by the appearance of teeth in the jaws, of the necessity of a substitution of solid food, in the place of that which had previously nourished the child from the mother's breast. It were well if the indications which nature affords us in this and in many similar instances, were regarded with a degree of interest commensurate with their importance. The absolute absence of teeth for the first six or seven months, clearly points out the impropriety of introducing any solid food during that period ; and by those who take nature as their guide, will be deemed sufficient to induce them to restrict infants to that food, which has been so bountifully provided for them, and for which alone the delicate state of the digestive organs is at first adapted ; whilst the time at which the change now under consideration takes place, is so defined—the change itself of so decided a character—and the object of its occurrence so obvious, that under ordinary circumstances it may almost be assumed as a law, by which to regulate the period, during which the maternal nourishment is required. We find then, that at the age of from six to eight months, or about that time, a number of teeth begin to show themselves, which are destined to masticate such food as will be required during childhood ; but which afterwards gives place to the stronger and more durable ones of the adult, the structure and

offices of which have just been described. These temporary teeth are but twenty in number, and differ in many important respects from those which are destined to succeed them.* There are on each side of each jaw two incisores,† one cuspidatus,‡ and two molares.§ Of these, the incisores and cuspidati are succeeded by the incisores and cuspidati of the adult, and the molares by the bicuspidates; the whole of the permanent molares being added to the original number. The temporary teeth are generally speaking, much smaller than the permanent; of a less firm and solid texture, and their characteristic forms and prominences much less strongly marked. The incisores and cuspidati of the lower jaw, are of the same general form as the adult, though much smaller, the edges are more rounded, and they are not much more than half the length of the latter. The molares of the child, on the contrary, are considerably larger than the bicuspidates which succeed them, and resemble very nearly the permanent molares: a circumstance which might be anticipated, as their office must be the same. The first temporary molaris is much smaller than the second. The latter is, in fact, almost as large as the first permanent, and by a person ignorant of the subject, and inexperienced in noticing the distinctions between them, which, however, are more easily seen than described, may be mistaken for it. The roots of these teeth are similar in number to those of the adult molares, but they are flatter and thinner in proportion, more hollowed on their inner surfaces, and

* Plate IV. fig. 1.

† Ib. c, c.

‡ Plate IV. fig. 2, a, a, b, b.

§ Ib. d, d, e, e.

diverge from the neck at a more abrupt angle, forming a sort of arch, the object of which is obviously to encompass, as it were, the bicuspid, which, as will be seen hereafter, are formed immediately underneath them, and within the span of their roots.

OF THE

ARTICULATION OF THE TEETH.

IN considering the maxillary bones with a reference to the teeth, it is necessary to take a somewhat different view of them, from that which is given in the usual routine of instruction in anatomy. As from the first rudiments of their formation to their completion in adult age, the changes which these bones undergo are synchronous with, and dependent upon, the ever varying state of the teeth, it will be proper to trace these changes, and to point out the progressive relations which the containing and contained organs bear to each other.

But as this can only be done intelligibly and usefully, by following them both in their mutual progress, this view of them will be deferred until the subject of the formation and progress of the teeth is discussed. Following the same plan, a description of the articulation of the lower jaw will be given when treating on the subject of mastication; the antrum maxillare with the diseases of that cavity, and the other portions of anatomical description, with the physiological or pathological subjects to which they relate.

I shall now, therefore, proceed to give a description of the alveolar process, as connected with the subject next to be considered, the *articulation* of the teeth.

OF THE ALVEOLAR PROCESSES.

The alveoli,* or cells, which contain the roots of the teeth, are a series of cavities in the alveolar processes of the upper and lower maxillary bones. These processes form in the adult a more or less elliptical arch, bounding the inferior border of the upper, and the superior edge of the lower jaw. They consist of an external and an internal plate, with transverse bony laminæ, forming the parietes of the alveolar cavities. Their substance is internally loose and cellular, but the outer and inner plates are smooth and compact. The alveolar cavities correspond exactly in number and form with the roots of the teeth which they contain; those teeth which possess several roots having alveoli similarly divided; it is, therefore, unnecessary to describe them individually, as a comparison with the description already given of the roots of the teeth, will convey an accurate idea of them. The transverse process forming the lateral parietes of the alveoli, are rather more prominent than the external and internal plates of the bone, more especially at the anterior part of the arch, corresponding in a certain degree to the outline of the enamel. This, however, is not accurately the case, as there is a small space between the edge of the alveoli and the terminal line of the enamel all round the tooth, to which space the gum is attached. A slight degree of projection on the surface of the outer plate, following the outline of the alveoli, occasions a fluted appearance, which is particularly obvious on the anterior part of the bone. At the bottom of each cavity, one or more minute foram-

* Plate V. fig. 1, 2.

ina are seen, which transmit the vessels and nerves of the internal membrane of the teeth.

OF THE MANNER IN WHICH THE TEETH ARE ATTACHED
TO THE ALVEOLI.

The term applied by anatomists to that particular mode of articulation by which the teeth are fixed in the alveoli, is *gomphosis*.* In those teeth which possess but one root, as the incisores and cuspidati, and in those which have two perpendicular ones parallel to each other, as the inferior molares, the firmness of their articulation depends principally upon the accurate adaptation of the size and form of the roots to the alveoli in which they are placed. But in the superior molares, which have three roots, their deviation from parallelism adds greatly to the solidity of their connexion with the jaw. The roots are not however so accurately fitted to their sockets as to be retained firmly in them after the solution of the soft parts by maceration. When the bones have been submitted to this process, the teeth with single or with parallel roots fall out, and even those with divergent ones become so loose as to be readily moveable. There are therefore soft parts which contribute to this end.

The periosteum of the maxillary bones, after covering the alveolar processes, dips down into each alveolar cavity, the parietes of which it lines. From the bottom of the cavity, where the vessels and nerve of the internal membrane enter, it appears to be reflected over the root of the tooth, which it entirely covers, as far as the neck, at which part it becomes intimately connected with

* Plate VI.

the gum. Hunter, and he has been followed by other anatomists, believed that there is only a single layer of periosteum common to the alveolus and the root; but I have repeatedly removed a tooth from the dead subject, and found not only the root covered, but also the alveolar cavity lined, with periosteum. When inflamed, this membrane becomes thickened, and is then very obvious. And it is not improbable, that the dental and alveolar layers become so closely connected by this circumstance, that on the extraction of the tooth, the united laminæ may be torn away, and the alveolar cavity be in parts denuded of its periosteum. The adhesion of the periosteum to the root is so firm as to prove its vascular connexion with the osseous substance of the tooth, and thus to afford a strong collateral argument in support of its organization.

In addition to these means of connexion, the teeth are doubtless rendered still more firm, by the vessels and nerves which enter them at the extremity of the roots. This is evidently shown, in those cases where the alveolar processes have become in a great measure absorbed from age or other causes; when the tooth, though extremely loose, will be found to require no inconsiderable force to separate it from the bottom of the socket, to which it had thus continued to be united, after every other kind of connexion was destroyed.

OF THE GUM.

There is yet another structure which assists more or less in this object, and that is the GUM. This substance, which differs in its structure and appearance from any other in the body, covers the

edge of the alveolar processes, both external and internal, and is intimately connected with them. Processes of it also pass over the transverse alveolar processes between the teeth, the necks of which are thus completely surrounded by it. In a healthy state the gum is very closely united to the teeth at their necks, terminating only where the enamel commences ; but from age, disease, accumulation of tartar, or the use of mercury, it often becomes absorbed with the edges of the alveolar processes, and the necks of the teeth are exposed. Its structure is peculiar ; less firm and hard than cartilage, and more so than the cutis. It is covered every where by the common mucous membrane of the mouth, to which it is so closely united, as to be separable only by maceration.* The gum is very vascular ; and although in a healthy state, it has but little sensibility, yet when inflamed, it becomes extremely painful and irritable.

* Mons. Serres, a French writer on the teeth, has described certain glands in the gum, which he supposed to secrete the earthy matter called tartar. This is too manifestly a mistake, to require any particular refutation ; the fact is, they are nothing more than simple mucous follicles.

OF
THE PARTS CONCERNED IN MASTI-
CATION.

THE TEMPORO-MAXILLARY JOINT.

IN order clearly to comprehend the subject of mastication, the principal end for which the teeth are produced, it is necessary to have a correct knowledge of the parts, which enter into the composition of the temporo-maxillary joint, of the ligaments by which its motions are restrained, and of the muscles by the action of which those motions are effected.

The inferior maxillary bone is articulated by its condyle on each side, to the glenoid cavity of the temporal bone. This cavity is of an irregular oval figure, and is placed nearly transversely, but with the external extremity more forward than the internal, as well as rather broader, to accommodate it to the larger circle described by the external extremity of the condyle. It is crossed by the *fissura Glasseri*, in which is found a foramen for the passage of the chorda tympani. The glenoid cavity is bounded anteriorly by an eminence called *eminentia articularis*, at the root of the zygomatic process, which is of considerable importance in modifying the motions of the jaw in mastication.

The condyle of the inferior maxillary bone which constitutes the principal moveable portion of the joint, is of a transverse oblong form, much smaller than the glenoid cavity into which it is received. Following the general figure and direction of that cavity, its anterior extremity is placed somewhat forwards; so that, were a line drawn backwards through the axis of each condyle, the two lines would meet at an angle, according to Mr. Hunter, of about 146 degrees. The glenoid cavity and the condyle are alike covered with a thin, smooth layer of cartilage, which is of a slighter texture than the cartilages of the joints in general, and peels off like the periosteum after maceration.

Between the condyle and the glenoid cavity, is situated a fibro-cartilaginous body called the *inter-articular cartilage*. Its form, like that of the condyle, is oval; its under surface is concave to receive the condyle, and the upper is moulded to the inequalities of the glenoid cavity. It is of a fibrous structure; the fibres are concentric, and become more dense towards the circumference.

There are two distinct sacs of synovial membrane belonging to this joint. The upper sac covers the superior surface of the inter-articular cartilage, and is reflected over the glenoid cavity; the lower covers the inferior surface of that cartilage and the head of the condyle. The upper synovial sac is sufficiently lax to allow the inter-articular cartilage freely to follow all the motions of the condyle.

From the relative position in which the parts composing this joint are placed, and from the close connexion between the inter-articular cartilage and the condyle, the articulation must be

referred to that species which is termed *arthrodia*, of which the glenoid cavity forms the receiving and fixed, and the inter-articular cartilage the received and moveable portion. It has been considered by some as a kind of double arthrodia, but as the motion of the joint is almost wholly confined to its upper division, the cartilage following all the motions of the condyle, the two latter portions must be considered as forming one moving body.* Still less can it be considered as belonging to the species of joint called *ginglymus*, to which some popular writers on anatomy have referred it.

There are three ligaments belonging to this joint :

1st. The *external lateral ligament*, which is short and thin, and composed of parallel fibres, connected by a dense cellular membrane. Its superior extremity consists of a broad attachment to the articular eminence and outer edge of the glenoid cavity, and to the anterior edge of the *meatus auditivus externus*. It extends obliquely backwards, and its opposite extremity is fixed to the outer side of the cervix of the lower jaw : in its course, its internal surface comes in contact with the inter-articular cartilage, and receives a layer of the synovial membrane.

2nd. The *internal lateral ligament*, is composed of a number of narrow slender fibres, of considerable length, attached above to the inner edge of the glenoid cavity : taking an oblique direction downwards and forwards, it is attached below to the ridge or spine at the upper and fore part of the posterior maxillary foramen ; by which little bony projection, and the connexion of this ligament with it, the dental vessels and nerve are protected from

* See Mr. Bransby Cooper's work on the ligaments, &c.

the pressure made by the motions of the *pterygoideus internus*.

3d. The *stylo-maxillary*, or *suspensory ligament*, is attached to the styloid process of the temporal bone by its superior extremity, and by its inferior to the angle of the lower jaw. The use of this ligament appears to be, to restrain the motion of the jaw forwards upon the articular eminence of the temporal bone.

THE MUSCLES EMPLOYED IN MASTICATION.

The motions of which the lower jaw is susceptible, in conformity with the structure now described, are free and extended. The simple ones are, depression, elevation, protension, and retraction; and as the two latter movements may be restricted to one side, we may add lateral motion, or partial rotation, to the list. These different motions are capable of great complication.

When the lower jaw is depressed, the condyles are brought forwards upon the articular eminences, and the angles of the jaw carried backwards; the centre of motion, therefore, is not in the condyles, but a little below them, in a line apparently between them and the posterior maxillary foramina. This circumstance allows of the mouth being opened to a much greater extent than it could have been, had the motions of the condyle been restricted to the glenoid cavity. The jaw may indeed be depressed to a certain extent without the condyles changing their situation, but this requires an effort, and is, after all, a very circumscribed action. The muscles which act as the principal depressors of the jaw are the *digastrici*; the origin and insertion, the direction, and pulley-like attachment of which,

are most beautifully adapted for their office. They are assisted by the mylo-hyoidei and genio-hyoidei when the os hyoides is fixed.

The elevation of the jaw is effected by four pairs of muscles, the united power of which is immense. These are the *temporales*, *masseteres*, *pterygoidei interni*, and, in some degree, the *pterygoidei externi*.

When the jaw is simply brought forwards, without being depressed, a movement which I have termed protension, the condyles are thrown upon the articular eminences, and the inter-articular cartilages follow the movement nearly to the same extent. It is principally produced by means of the *pterygoidei externi*. When one of these muscles acts alone, the chin is thrown towards the other side, and then a sort of partial rotation is performed, in which the inner extremity of the condyle, on the fixed side is made the centre, on which the remainder of the bone describes the arc of a circle. This, however, is only comparatively correct, for the whole jaw is, in fact, thrown in a small degree on one side by this movement.

The jaw is retracted, and the condyles restored to their natural situation, by the partial action of the *temporales* and *masseteres*.

OF MASTICATION.

Mastication, or the comminution of the food, preparatory to digestion, is performed by the complication of the various motions just described, and consists of two very distinct actions, namely, biting, or the separation of a portion of food by means of the incisores; and manducation, or the grinding of the food, by the molares.

The first of these actions is effected in the following manner ; the mouth being opened by the depression of the lower jaw, the food is placed between the inferior and superior incisores, the edges of which are then brought in contact by the action of the elevators, whilst, at the same time, the condyles are retained forwards on the articular eminences ; and, as the incisores are relatively longer than the other teeth, this contact of their edges is not accompanied by that of the surfaces of the molares. The elevators and retractors of the lower jaw are then thrown into strong action, by which the inferior incisores are pressed with great force against the superior ; and being, at the same moment, brought backwards and upwards, the portion of food is separated by exactly a similar action to that of cutting by a pair of shears.

The portion of food, being thus separated by the incisores, is then carried by the tongue and the muscles of the lips and cheek, between the upper and lower molares on one side, the jaw being a little depressed for that purpose, whilst, at the same time, a certain degree of lateral motion is given to it, towards that side on which the food is placed, by the condyle of the opposite side being thrown forwards upon its articular eminence. The jaw is then brought forcibly upwards, and the condyle at the same moment replaced in the glenoid cavity, a complicated movement of elevation and partial rotation being thus produced, the latter of which effects the bruising and laceration of the food. The position of the molares in the alveoli is admirably adapted to assist in this process, at the same time to give them the greatest possible strength and security. Those of the upper jaw

are situated with the crowns standing a little outwards, towards the cheek ; whilst the lower ones are placed in a contrary direction, so that their crowns overhang, in some measure, the inner alveolar plate.* The consequence of this arrangement is, that when the surfaces of the upper and lower molares are brought into contact, by the double action of elevation and rotation, just described, the direction of that movement is in accordance with the axis of the two rows of teeth applied against each other.

By a repetition of this motion the food is comminuted and reduced to a pulp, and thus prepared for deglutition.

COMPARATIVE VIEW OF THE MOTION OF THE LOWER JAW
IN INFANTS AND IN OLD PERSONS.

On examining the jaws of the child before the teeth are produced, considerable deficiency will be observed in the articulation. Instead of the free and extensive motion which the structure just described permits to the adult, the glenoid cavity is found to be circumscribed to little more than the size of the condyle, and the articular eminence is not yet formed : the motion is consequently confined to simple depression and elevation, with scarcely the least approach to rotation. The centre of motion is, in fact, in the condyle.

A consequence almost identical with this, is produced by the state of the mouth in very old persons, though the circumstances producing this similarity are essentially different. When the whole of the teeth have been removed, the alveolar pro-

* Plate VI. fig. 2.

cesses become so completely absorbed, that the face is shortened, as Hunter justly observes, by about an inch and a half ; that is to say, by nearly or quite the length of the upper and lower teeth. When therefore the lower jaw is depressed only so far, as that its base is brought parallel with the upper, that is to say, to the situation at which the teeth, did they still exist, would have met ; the mouth is sufficiently opened for the reception of food, and for all other purposes ; and it is never necessary to open it so wide as to bring the condyles forwards on the articular eminences ; from the same cause also, namely, the loss of the teeth, the mode of grinding the food by alternate lateral motion is not required, and, like that of the child, it is restricted to depression and elevation. When the mouth of a person in this condition is closed, the chin, describing the segment of a longer circle than the alveolar processes, whilst they existed, had done, is thrown very much forwards, so as to project far beyond the upper jaw ; what little mastication can be performed at this age, is therefore effected by the sides of the jaws, the only part at which they can be brought into contact.

OF
THE FORMATION OF THE TEETH.

THE mode in which the teeth are produced, so different from that of the formation of any other part of the body, although a subject which has engaged the attention of physiologists, ever since physiology became a science, has not, until within comparatively few years, been perfectly understood. Dr. Blake was certainly the first who clearly comprehended this curious process: he not only removed much of the obscurity and difficulty in which previous authors had left it, but by his minute dissection, and accurate observation, demonstrated the most interesting and conclusive facts, which the labors of subsequent anatomists have only served to confirm. In following a series of dissections some years since, I found comparatively little to add, and scarcely any thing to correct. I commenced my observations however on subjects at an earlier period of foetal existence than those recorded by Dr. Blake, and discovered in them the rudiments of the teeth, at nearly two months earlier than he had done.

About two months after conception, if the jaws be examined with care, an extremely soft jelly-like substance is found lying along the edge of each maxillary arch. At the third month this has assumed rather a firmer consistence, and is contained within a shallow groove of bone, which consti-

tutes the first step towards the formation of the external and internal alveolar plates.* At this period the pulpy substance becomes partially divided into distinct portions,† and corresponding filaments of bone are seen shooting across from one side to the other of the bony groove, to form the future transverse divisions of the alveoli. These pulps are the rudiments or bases upon which the teeth are formed. At this time they lie upon the vessels and nerves which run along the bottom of the groove; they are very soft, gelatinous, and semi-transparent; and each is partially enclosed in a membrane or sac. At the fourth month, if the sac be opened a small point of ossification is found to have been deposited upon certain of the pulps, and this is the commencement of the formation of the bony substance of the teeth. The ossific matter is secreted, not from the pulp itself, but from an extremely delicate, thin, vascular membrane, which covers its surface, and is closely attached to it by vessels. This membrane, which I shall term the proper membrane of the pulp, is, with much probability, conjectured by Dr. Blake to be “a propagation of the periosteum of the jaw.” The sac which envelopes the whole, is thick in its texture, and consists of two lamellæ, which are easily separable after a short maceration, especially in the larger animals. Directly opposite assertions have been made respecting the vascularity of these lamellæ. Hunter declares that, “the external is soft and spongy, without any vessels; the other is much firmer and extremely vascular.” Dr. Blake on the contrary asserts, that “the external is spongy and full of vessels; the internal one is more

* Plate VII. fig. 1, 2.

† Ib. fig. 3, 4.

tender and delicate, and seems to contain no vessels capable of conveying red blood." Mr. Fox, however, discovered by injection, that both of them are vascular, and I have in my possession several preparations which demonstrate the truth of his statement.* This membrane, the use of which will be explained hereafter, is not attached to the pulp, except at its base, where the vessels enter; nor originally to the bony rudiments of the teeth, but only loosely surrounds them; its external part is however most intimately and inseparably connected with the gum, from which source it is supplied with its vessels and nerves, whilst the pulp and its proper membrane derive *their* organization immediately from the dental branches. The bone is first deposited on the points of the teeth, and assumes by degrees the appearance of a thin shell, covering the pulp and its proper membrane, which retire, as it were, as the bone continues to be deposited. It is obvious, therefore, that the bony shell is interposed between the pulp with its membrane, and the investing sac. As the pulp is originally of nearly the same form as that which the crown of the tooth is destined to assume, ossification commences on as many points as the future tooth will have eminences on its surface:† thus the incisores and cuspidati commence with one point, and the molares with several. When the shell of bone has proceeded so far as nearly to cover the original form of the pulp, the alveolar processes having become more developed, and consequently the alveoli deepened, and more perfectly separated by the growth of the transverse plates, the pulp elongates at its base to form the root; in

* Plate VII. fig. 5, a, b. fig. 6.

† Plate VII. fig. 7, 8.

those teeth which have only one, a conical shell of bone is formed around the pulp, which continues to increase in length in proportion as the ossification advances; whilst in those which have several roots, a division of the pulp takes place at this part into a corresponding number of processes. When therefore the external lamina has advanced to the part where this division occurs, a process of bone is sent across from one side of the shell to the other, between the divided processes of pulp, and ossification is then continued around each respectively.*

It will be seen by the foregoing account of this curious process, that the outer lamina of bone is first completed, and that lamina after lamina is deposited, one within the other, the pulp still receding, until at length there remains only the permanent cavity of the tooth, lined with its proper membrane, and filled with the remaining portion of the pulp, which now serve as the bed upon which the vessels and nerves ramify previously to their entering the bony substance of the tooth.

OF THE FORMATION OF THE ENAMEL.

When the bony shell has extended as far as the neck of the tooth, the external membrane or sac attaches itself closely to this part, though still loosely investing its body. At this time a remarkable alteration takes place in its substance, which becomes thickened, and much more vascular, particularly the inner layer, over the whole internal surface of which the vessels may be seen obviously enlarged, and capable of receiving a much more

* Plate VII. fig. 9.

perfect injection. The object of this change in the condition of the membrane is to produce the increased supply of blood required for the secretion of the enamel. It is more evident in the permanent than in the temporary teeth, partly from the difference in their size, but doubtless more especially because the demand for the increased determination of blood is greater in the permanent, as the enamel is required to be of much greater proportional thickness.

It now begins to pour out from its internal surface a thickish fluid, which is speedily consolidated into a dark chalky substance, and afterwards becomes white and hardened by more perfect crystallization. This is the enamel. It is first deposited on the points at which ossification had commenced, and by degrees covers, in one continuous layer, the whole crown of the tooth. It appears that in the human subject, and in other animals whose teeth possess but two distinct substances, bone and enamel, that the internal lamina alone performs the office of secretion; but in those which require a third substance, the *crusta petrosa* of Dr. Blake, as the graminivorous quadrupeds, this is secreted by the external lamina, after the internal had performed its office of producing the enamel.

ENUMERATION OF THE MEMBRANES OF THE TEETH.

As much obscurity still exists respecting the number and arrangement of the membranes belonging to the teeth at different stages of their growth, the following recapitulation may perhaps be useful in giving at one view, a distinct and accurate idea of them. M. Delabarre has, it is true, given dia-

grams, in his excellent treatise on the second dentition, intended to illustrate the different statements of all the principal writers on the subject, but it does not appear to me to have come from his hands in a much less confused state than before; at least he has essentially mistaken the meaning of the English authors, Hunter, Blake, and Fox, to whom, however, he has the liberality, on all occasions, to award the meed of unqualified eulogium. I cannot refer to this work without bestowing on it the praise it deserves, not less for the candor and liberal feeling which it evinces towards other writers, than for the scientific views and practical usefulness which characterize it.

The membranes which I have described in different parts of this work, may be divided into *deciduous* and *persistent*. The deciduous membranes are the two lamellæ, which, forming the sac which envelopes the rudiments, secrete the enamel from the internal surface, and then become wholly absorbed. The figure which M. Delabarre gives of the outer layer of this membrane is, according to my view of its structure and connexion, entirely erroneous, as he supposes it to be continued over the root of the tooth to form its periosteum. There is no reason whatever to believe that it extends farther than the neck of the tooth with the inner lamella, and they doubtless become absorbed together. Indeed the outer layer must be considered as merely rudimentary in man, and in the other animals with simple teeth, and becomes fully developed for the performance of its proper function of secreting the *crusta petrosa*, only in those animals whose teeth possess that substance. Its office has, therefore, no relation whatever to

that of the periosteum, and dissection confirms the opinion of its true structure which analogy might thus have suggested. Indeed the figures in M. Delabarre's work, which illustrate the formation and growth of the permanent teeth, are themselves a direct contradiction to the account he has given of the use of this membrane, for in no one of them is it found to descend lower than the neck of the tooth, whatever may be the degree of advancement in which the specimens are exhibited; and the structure is too distinctly marked in his engraving to allow of the possibility of mistake. I have dwelt the more particularly upon this subject, because on the truth of the view I have taken of it, will depend the correctness of the analogy which I infer to exist in the formative structures of the teeth in all the mammiferous animals, although certain of these structures may be more or less developed, according to the degree in which their peculiar functions are required.

The *persistent* membranes are, 1st, the internal periosteum of the dental cavity, which, during the formation of the tooth, had performed the office of secreting the bone: 2d, the periosteum of the root, which is doubtless a reflection of (3d,) the periosteum of the alveolus, of which that of the cavity, just mentioned, is also most probably a production, according to the views of Dr. Blake. Thus the periosteum of the maxillary bones must be considered as the origin from which these three persistent membranes are derived.

Of the rage for discovering analogies in the structure and formation of different organs, which has been carried to such an extent in the theories, or, more correctly speaking, the hypothesis of some of

the continental physiologists, perhaps scarcely a more remarkable instance can be selected than that which assumes the teeth to be mere appendages to the integument, and in fact analogous in their formation and development to the hair in mammalia, and the feathers in birds.* On what possible grounds this opinion has been formed, it is not easy to decide. It may be conjectured that the fact of the investing sac being intimately connected with the gum, might have first led to its adoption. This apparent support to the hypothesis is, however, proved to be unreal and visionary, when we recollect that the sac thus connected with the gum, has, in reality, nothing whatever to do with the formation of the true tooth, is wholly unconnected with it, that its office is confined to the secretion of an inorganic crystalline deposite, and that it becomes permanently removed by absorption as soon as this object has been effected: whilst the tooth itself is the production of a substance absolutely independent of the gum, and immediately connected, by its vessel as well as by its secreting membrane, with the bone of the jaw.

* The following genuine anecdote exhibits the favorite theory of our lively neighbors in a sufficiently amusing point of view. A very distinguished friend of mine, being one day in the Jardin des Plantes, was eagerly accosted by his friend, Mons. —, one of the most ingenious of modern physiologists, and a well known zealous supporter of this doctrine of analogies, who coming up to him with an expression apparently full of some important discovery, exclaimed with much naïveté, "Aha, L——, we have six legs!"

OF THE FORMATION OF THE PERMANENT TEETH.

The formation of the permanent teeth, although essentially proceeding upon the same general principle, and produced by means of similar structures as those by which the temporary ones are formed, differs in some very remarkable points from that process, and forms, if possible, a still more beautiful and interesting illustration, both of the variety and harmony with which the different formative processes of animal organization are carried on. The rudiments of the permanent teeth, instead of being original and independent, like those of the temporary, are in fact derived from them, and remain for a considerable time attached to, and intimately connected with them.

At an early period in the formation of the temporary teeth, by a process which reminds us of the gemmiparous reproduction in the lower classes both of animal and vegetable life, the investing sac gives off a small process or bud, containing a portion of the essential rudiments; namely, the pulp covered by its proper membrane. This constitutes the rudiment of the permanent tooth. It commences in a small thickening on one side of the parent sac, which gradually becomes more and more circumscribed, and at length assumes a distinct form, though still connected with it by a peduncle.* For a time the new rudiment is contained within the same alveolus with its parent, which is excavated by the absorbents for its reception, by a process, as far as I am acquainted, unparalleled in the phenomena of physiology—unless indeed the absorption of the roots of the temporary teeth may be considered

* Plate VIII. fig. 1, 2.

as analogous—and which has not been noticed by any writer on the subject. It is not, as has been believed, in consequence of the pressure of the new rudiment upon the bone, that this absorption is produced, but by a true process of anticipation; for I have seen, both in the human subject, and more evidently still in the foal, the commencement of this excavation before the new sac was formed, and, consequently, before any pressure could have taken place on the parietes of the socket. The absorption does not, in fact, commence in the smooth surface of the alveolus; but in the cancelli of the bone immediately behind it, where no pressure could operate; and it is only by carefully removing the parietes of the socket, where the excavation is intended to be formed, that the very commencement of the process can be observed. By degrees a small recess is thus formed in the parietes of the alveolus, in which the new rudiment lodged, and this excavation continues to increase with the increasing size of the rudiment, whilst at the same time the maxillary bone becomes enlarged, and the temporary tooth advancing in its formation, rises in the socket. The new cell is thus gradually separated from the former one, both by being itself more and more deeply excavated in the substance of the bone, and also by the deposition of a bony partition between them: and the rudiment of the permanent tooth is at length shut up in its proper socket.* There is not, however, even now a total disunion between the two teeth, for as the temporary one grows and rises in the jaw, the connecting cord or peduncle elongates; and although the sac from which it is derived, by degrees

* Plate VIII. fig. 3.

becomes absorbed, it still remains attached to the neck of the temporary tooth, even long after the latter has pierced the gum; and this connexion between the temporary tooth, the permanent rudiment, and the gum, is thus kept up by means of the cord, through a small opening in the top of the new alveolus, which is seen perforating the alveolar process immediately behind each temporary tooth.*

The situation of each permanent rudiment when its corresponding temporary tooth has made its appearance though the gum, is beneath and a little behind the latter,† and rather farther from the centre of the jaw. From the preceding statement, then, it will be readily understood that the upper part of the new sac, being by means of the cord connected with the gum, assumes, by and by, the same relation to that substance as that which the temporary rudiment, as before described, had originally sustained: whilst from its substance being deeply imbedded in the jaw, the vessels and nerves which had entered into the composition of the new process of pulp in its first production, probably become so enlarged and modified in their structure, as ultimately to form the true dental branches. This is much more probable than to suppose that a new set of nerves and vessels are given off from the maxillary branches to join the pulps at a distance, through an intervening layer of bone of an indefinite thickness, to supply every new tooth.

We now therefore find the new rudiment in a state nearly analogous to that in which the parent tooth was originally placed, and with similar rela-

* Plate VIII. fig. 4, 5.

† Plate VIII. fig. 6, 7.

tions to the surrounding parts; the sac above attached to the gum, and the pulp beneath covered with its proper membrane, connected by its vessels, &c., with the jaws. The foregoing account will convey an accurate idea, according to my views of this curious subject, of the mode in which the permanent teeth are produced; and I shall now enter upon a more detailed account of the progress of both sets, from their first rudimental existence to their perfect development.

THE PROGRESS OF THE TEMPORARY TEETH.

The ossification of the temporary teeth commences, as has been mentioned, at about the fourth month, at which period the pulps of the whole of the temporary teeth, and of the first permanent molares, may be observed, though the latter are not yet very distinctly formed. At the fifth month, or rather earlier, I have seen those of the permanent central incisores, though extremely small, and still closely attached to the parent sacs. Blake mentions the eighth month as the earliest time at which he had distinguished them, and Fox not until a month later.

At birth, the formation of the transverse alveolar plates has proceeded so far as to form, with some distinctness, the alveoli of the temporary incisores and cuspidati, and partially those of the molares: and ossification has advanced on all the temporary pulps so as to form shells of bone reaching some way over their crowns; it has also commenced in a minute point on the first permanent molares. The sacs of the permanent incisores and cuspidati may also be distinctly perceived, lying in contact with the temporary ones, immediately behind them,

and exhibiting in a very beautiful manner, the peculiar connexion between them, which has been described. It is not until this period, that the nature of this connexion, and the true mode of the formation of the permanent teeth can be investigated with any satisfactory result ; for the new sacs are previously too obscure and indistinct, to afford any very clear idea of the subject. As ossification proceeds, the roots of the teeth continue to elongate, until first those of the incisores, and subsequently the others, can no longer be contained within the alveoli, and preparation is made to facilitate their passage through the gums by absorption of the containing parts. When the tooth has arrived at this stage, it presses upon the gum, a portion of the sac being still interposed ; and, as this membrane has already secreted the enamel, it becomes absorbed at the point where pressure is first made, and the gradual removal of the sac and gum is the consequence. Whether this absorption is ever spontaneous or not, is I think very doubtful ; but it certainly is not improbable, that when the membrane has fulfilled its office, it becomes removed by the spontaneous action of the absorbents, independent of pressure. Be this as it may, it is obvious from the account which has been given of the attachment of the sac to the neck of the tooth, previous to its protrusion through the gum, that the notion held by Mr. Fox, of the sac being distended as the tooth elongates, must be erroneous ; for if they be thus inseparably united, the membrane must follow the motion of the tooth and be raised with it, until removed by absorption.

The age at which the teeth first make their appearance varies considerably, and frequently with-

out any apparent reference to the constitutional powers of the child. Instances are not wanting in which children have been born with two or more teeth, whilst in many other cases, they have not come through the gum until fourteen or sixteen months, or even as late as two or three years. In general, however, dentition may be said to commence at the age of from five to eight months, and it usually proceeds in the following order, the inferior almost always preceding the superior for a longer or shorter time.

From 5 to 8 months	the four central incisores.
From 7 to 10	the four lateral incisores.
From 12 to 16	the four anterior molares.
From 14 to 20	the four cuspidati.
From 18 to 36	the four posterior molares.

These periods are, however, only given as a general rule, liable to continual exceptions, not only in the time at which the different teeth appear, but also in the relative order of their precedence.

OF THE

IRRITATION PRODUCED BY DENTITION, AND
THE DISEASES WHICH RESULT FROM IT.

A RECURRENCE to the relative condition of the teeth to their including parts, at that period when they are about to pass through the gum, and to the means by which their exit is effected, will readily explain the causes of those numerous and severe affections, both local and constitutional, to which infancy is exposed at this important and critical epoch. The emancipation of the teeth is produced by the gradual absorption of the investing membrane and gum, either as a spontaneous process, or, more probably, as the result of moderate and gradual pressure, produced by the rising of the tooth. When, therefore, the advance of the tooth proceeds faster than the necessary absorption of the parts which have enclosed it, it is forced against the gum, whilst the investing membrane is compressed between them ; and a proportional degree of counter-pressure is also produced upon the pulp, on which the ossification of the tooth is still proceeding. These causes—and more especially the latter—excite a greater or less degree of constitutional derangement : at one time confined to some trifling affection of the skin or of the bowels, at others assuming the most severe and dangerous forms of disease. If we consider the state of the constitution at this early age, when every part of

the system, as well as every structure, is in the highest state of sympathetic excitement, without having yet acquired sufficient vigor and firmness to resist the effects of the slightest disturbance of its functions; when, too, the process of new formation is going on, with a rapidity which makes incessant demands upon the nervous system, keeping it in a perpetual state of almost irritable excitement, requiring the most perfect harmony in all the actions of the body, to prevent the occurrence of serious disturbance—it will not appear surprising that any unnatural and violent interference with a structure so highly, and yet so delicately organized as the rudimentary pulp of the teeth, should produce a corresponding commotion in the whole system. We consequently find, not only constitutions of the most healthy character thus become the subjects of acute forms of disease, but also, that the latent seeds of scrofula and other malignant constitutional disorders are frequently brought into action by this cause.

To enter upon a history of the consequences which result from the irritation of teething would be to treat generally of all the diseases of infancy; for there is scarcely a disease to which this period of life is subject, and scarcely a symptom appertaining to those diseases, which is not at times produced, or at least augmented, by this cause. It is one of the opprobria of medical literature, that a good practical treatise on this subject is still a desideratum. It would be as obviously inconsistent with the plan of the present work, as it would be presumptuous in its author to attempt even a sketch of these various affections. I shall, however, venture to make a few observations on some

of the most remarkable, and, particularly, on their general treatment, so far as it may be indicated by the cause which produces them.

It is seldom that children acquire their teeth without some degree of local irritation and of constitutional derangement. Even in the most favorable cases, the gums are red, enlarged, and painful, and a disposition to fever occurs, usually attended with an unhealthy action of the liver. In these mild attacks, however, the symptoms themselves in a great measure produce their own remedy: for the salivary glands, partaking of the excitement of the neighboring parts, secrete an unusual quantity of saliva, which diminishes the action of the vessels, whilst the constitutional irritation is also generally relieved by the occurrence of a moderate diarrhœa. A slight eruption of the skin frequently occurs, and various other symptoms, which while they remain moderate in their degree, and unconnected with any organ of importance to life, are rather to be considered as remedial than morbid, and immediately subside upon the appearance of the tooth which produced them.

The general symptoms, however, frequently assume a more severe and alarming form. The constitutional irritation becomes excessively distressing, immoderate diarrhœa comes on attended with severe griping, and the fæces are fetid, discolored, and often of a clayey consistence, mingled with large quantities of unhealthy, viscid mucus. The urine is scanty and turbid, and a purulent discharge sometimes takes place from the urethra, accompanied with much difficulty and excruciating pain in passing the urine. The skin is hot and dry, the pulse rapid and fluttering, the respiration quick and

labored, and the countenance expressive of extreme anxiety and pain. The difficulty of breathing often increases to an alarming degree, with painful inspiration, cough, and, in short, every symptom of pneumonia. The brain, too, is frequently affected; the pupils of the eyes are permanently expanded, the head is continually moved to and fro with an uneasy and restless motion, accompanied with incessant moaning. Spasm of the voluntary muscles frequently succeeds, and convulsions at length recur, at intervals, with increasing violence; which, unless immediate relief be obtained, too often terminate at once the little patient's sufferings and existence.

The symptoms which I have here described as connected with a morbid state of the brain, often arising either from an overcharged condition of the vessels, or from actual effusion, do not always terminate fatally; but, even where they are for the time relieved, and their acute form subdued, the occurrence of confirmed hydrocephalus is amongst the most common results of such affections. It appears, indeed, that the irritation of dentition has not been sufficiently attended to as the origin of this disease. Were this view of its cause more generally taken, it is, I think, probable that it may, in many cases, be arrested in its earlier stages, and its dreadful consequences—death, or a state of idiocy far worse than death, be frequently prevented.

It is not my province to enter into a detail of the various and anomalous morbid affections which result from this cause. Whatever symptoms, whether local or constitutional, can be supposed to arise from the highest degree of local irritation, will at

times be found to occur during dentition. Various forms of eruptive disease are occasionally imitated by cutaneous affections, springing from this source. Painful affections of the muscles of the limbs, swellings of the hands and feet, spasmodic contractions of different muscles of the body or extremities, form a small part only of the effects of this source of irritation.

The treatment of all these diseases requires only a reference to their cause to be rational and successful. Of the general remedies, the most important are those which are directed to the state of the digestive organs, aided by the warm bath, and others which, by acting upon the skin, and especially upon the lower parts of the body, diminish the determination of blood to the brain and viscera. But, whilst every necessary attention is paid to the symptoms, and the proper remedies are directed to them with promptitude and decision, it is not to be forgotten, that the cause still remains unremoved and untouched. A moment's recurrence to the relation which exists between the teeth and the including parts, will readily point out that it is only by removing the pressure which has occasioned all the mischief, that any thing beyond the mere temporary palliation of the symptoms can be hoped for. As soon, therefore, as any of the affections now described, or others, which can possibly be supposed to arise from this cause, make their appearance, the gums should be carefully examined, and wherever there is any unusual redness or turgescence, and especially if it occur over the part where the next tooth is expected to appear, the including parts should be freely and effectually divided. It is not sufficient that the

incision should merely pass through the gum—the lancet must be carried down to the rising tooth itself, and only stopt when the resistance of its point is felt against the edge of the instrument. The form of the gum lancet should be broad and somewhat rounded, and its edge extremely sharp. The only precaution necessary in its use is, so to direct it, in making the incision, that the cord of connexion between the temporary and permanent tooth shall be carefully avoided, which is readily ensured by directing the edge rather towards the outer part of the gum.

The prejudices of former times against this simple and most efficacious operation, are fast yielding to the frequent evidence of its harmlessness and utility. It is impossible for the most prejudiced to witness the effects which continually result from it, without becoming a convert to its use. In the midst of the most imminent danger, when death has almost been anticipated as the only relief from severe and hopeless suffering, this simple and trifling operation has, in innumerable instances, restored the little sufferers to their parents, in a state of ease and safety, and in so short a space of time as would scarcely have appeared credible.

OF THE
PROGRESS OF THE PERMANENT
TEETH.

It has been already stated that of the permanent teeth, those which are first formed are the anterior molares, the first point of ossification on which may be seen at birth : and at about the age of twelve months, or rather less, it will be found to have proceeded to a considerable extent on these teeth, and also on the permanent incisores, and to have commenced on the lower cuspidati, the upper ones being generally two or three months later. About the time when all the temporary teeth have made their appearance, ossification is found on the points of the bicuspides, and the bony shells of the teeth before mentioned, have acquired considerable size.

As most of the permanent teeth are larger than those which precede them, and as they are placed a little behind them during their progress, and consequently confined within the segment of a smaller circle, it is obvious that as they approach more and more nearly to their ultimate size, they must become very much crowded in the jaw. The examination of the maxillary bones in a child of about five years old, will show this fact in a very striking manner. At this period the jaws being considerably deepened by the development of the alveolar processes, the sockets in which the permanent teeth are lodged, will be found placed beneath

those of the temporary, some higher than others, and the bony shells are closely packed in such a manner as to occupy the least possible space. Thus, in the upper jaw, the central incisores are situated immediately beneath the nose, the lateral incisores thrown back behind the points of the cuspidati, and the bases of the latter scarcely a quarter of an inch below the orbit : in the lower jaw the cuspidati are placed at the very base of the bone, with only a thin layer beneath them ; but the crowding is much less considerable than in the upper jaw, from the smaller comparative size of the incisores.

At from six to seven years of age, the whole of the permanent teeth are more or less ossified, excepting the *dentes sapientiæ* ; so that, previously to the shedding of any of the temporary teeth, there are at this time no less than forty-eight teeth in the two jaws ; namely, twenty deciduous, the whole of which are perfected, and twenty-eight permanent, in different degrees of development, within the bones.

The following is the relative position of the two sets at this period. The permanent central incisor of the lower jaw is placed immediately beneath the temporary, with its point directed a little backwards, behind the partially absorbed roots of the latter. The lateral incisor, not yet so far advanced, is placed deeper in the jaw, and instead of being immediately beneath the temporary, is situated with its point between the roots of this and the cuspidatus. The permanent cuspidatus is still very deeply imbedded in the bone, with its point rising between the roots of the temporary cuspidatus and the first temporary molaris. The two spreading roots of the latter encompass, as it were with-

in their span, the first bicuspid, and those of the second temporary molaris, in like manner, the second bicuspid. Nearly a similar arrangement is found to exist in the upper jaw, excepting that the teeth are altogether more crowded. The lateral incisor is placed farther back, particularly its point; the cuspidatus is directed more outwards, as well as the bicuspides; circumstances which will hereafter be seen to be of some practical consequence in the treatment of irregularity.

The dentes sapientiæ begin to receive their ossification most commonly at about nine years of age, varying, however, in this respect, as much as in the period of their ultimate appearance through the gum.

OF THE SHEDDING OF THE TEMPORARY TEETH.

The change of the temporary teeth for a more numerous set, of a stronger and more durable structure, and of increased power of mastication, is a physiological fact of no small practical importance, when considered as indicative of the necessity of a different species of aliment in childhood, from that required for the support of the system, in a more advanced and perfect state of development. In what that difference would have consisted had man remained in a state of nature, it is not now possible to decide; and were it possible, it would scarcely lead to any practical result in his present artificial mode of existence; but in the view of the thinking and philosophical practitioner, on whom it often devolves to direct in a great measure the regimen of families, the fact will always appear important, as affording a general guide to his dietetic regulations. The difference in structure be-

tween the two sets of teeth, and the ages at which the weaker are exchanged for the more robust, are the two points to which his attention should be principally directed, and upon these may, with some degree of certainty, be founded the most rational and practical rules of diet at this period of life.

The mode in which this change is effected has been, at different times, attempted to be explained according to a variety of theories. Of the erroneous doctrines of the older writers—of the mechanical abrasion of the roots of the temporary teeth, by the friction of those of the permanent, as advanced by Bunon—of the acrid humor, supposed by Bourdet to act as a solvent; and of other fancies equally absurd, it is unnecessary now to speak; for it is useless to controvert what no one will again believe. I shall therefore confine myself to an account of the progress of this change, and of the operation by which it is actually effected.

It has been already stated that the permanent teeth, during their formation, are crowded together in the jaw, by being placed in a smaller arch than they would occupy if regularly arranged side by side. As the latter, however, is their destined situation, we find that, as soon as they have advanced to a certain point in their formation, and can no longer be contained within their own alveoli, absorption takes place in the anterior parietes of those cavities, by which means the teeth are allowed to come, in some measure, forwards. In consequence of this absorption, it often happens, that not only the socket of the corresponding temporary tooth, but that of the tooth on each side also is opened to the permanent one. Absorption now commences in the root of the temporary tooth, gen-

erally on that part nearest its successor, and this goes on by degrees as the latter advances, until the root is completely removed ; the crown at length falls off, leaving room for the permanent tooth to supply its place. The absorption of the root seldom, if ever, commences at its extremity, but generally at a considerable distance from it, and often near the neck. When a portion of it has been removed, it has somewhat the appearance of being broken, but a little observation will soon enable any one instantly to detect the difference.

It has long been universally supposed that this absorption is produced by pressure of the advancing permanent tooth, first on the interposed partition of bone, and then on the root of the deciduous tooth ; though even the supporters of this opinion are obliged to acknowledge that there are instances in which pressure cannot have occurred, and the roots have still been absorbed. It is certainly unphilosophical to attribute a phenomenon to the two distinct causes, when one alone is sufficient for its explanation ; and as there are instances in which this absorption goes on without the *possible* existence of pressure, it is fair to conclude that the cause, be it what it may, which produces the effect in those cases, is sufficient to its production in all others. It often happens that the root of the temporary tooth is wholly absorbed and the crown falls out spontaneously, long before the succeeding tooth has approached the vacant situation ; and at other times, when the latter has advanced so far as to make its appearance through the gum, absorption of the former tooth has been so tardy, that it continues to occupy its situation as firmly as ever. Still, as a general rule, the two actions are consentaneous,

and this absorption may perhaps be considered as an additional illustration of that law to which I have already alluded, when treating on the reception of a permanent pulp into a new cell ; and may, like that, be termed a process of anticipation. In both instances, the existence, though not the pressure, or even the contact, of the new body is necessary to excite the action of the absorbent vessels ; and we accordingly find that in those cases, by no means unfrequent, in which the temporary teeth retain their situation in the mouth, with considerable firmness, until adult age, the corresponding permanent ones have not been formed.

Mons. Delabarre has, with no little confidence, advanced a theory to account for the removal of the temporary teeth, which I should scarcely have noticed but for the general respectability of his work, and a disinclination to suffer an erroneous opinion to pass unrefuted. Having, with his usual acuteness, observed the increased thickness and vascularity of the sac as soon as the crown of the tooth is covered with ossification, which I have already mentioned as preparatory to the secretion of the enamel, he assumes that this change in the state of the membrane, is intended for the purpose of removing the root of the temporary tooth, by being placed in contact with it during its growth. But that this cannot be the case, is proved by the frequent commencement of the absorption, in a part the most remote from the sac of the permanent tooth ; and, in all cases, by its action being continued throughout the whole length of the root, to a great part of which, its successor can scarcely be said even to approximate during the process.

For a theory to be true, it must be applicable to exceptions as well as to general rules ; and if tried by this test, the opinions which I have combated will, I think, be proved to be fallacious.

The change of the temporary for the permanent teeth, commences, in the majority of instances, at about seven years of age, though I have occasionally known it to occur as early as five, and as late as eight years and a half. The first permanent molares usually pierce the gum before the loss of the temporary central incisores, and their appearance may be considered as indicative of the approaching change. The following are about the medium periods at which the different permanent teeth are generally cut, but so irregular are they in this respect, that comparatively little dependence can be placed on such a statement. Those of the lower are here indicated, and they most commonly precede the upper by about two or three months ;—

Anterior molares,	. . . . .	6½ years.
Central incisores,	. . . . .	7 “
Lateral incisores,	. . . . .	8 “
Anterior bicuspides,	. . . . .	9 “
Posterior bicuspides,	. . . . .	10 “
Cuspidati,	. . . . .	11–12 “
Second molares,	. . . . .	12–13 “
Third molares, or <i>dentes sapientiæ</i>,	. . . . .	17–19 “

OF THE INCREASE OF THE MAXILLARY BONES.

During the formation and growth of the teeth, important changes are continually taking place in the state of the jaws, which it is necessary now to trace, in order to understand the principles upon which irregularity is to be prevented or remedied. In the first place, the relative proportions between the maxillary bones and the teeth vary considerably, at different periods of their growth, without a knowledge of which, it would be impossible to comprehend in what manner the former become ultimately accommodated to the difference in size, between the permanent and adult sets. In the second place, the form of the jaws themselves also undergoes a great alteration during the advance of the permanent teeth, to afford room for the three molares, which are added to the number of the former set. The jaws of a child, anterior to the ascending plate in the lower, and to the tubercle in the upper, are semicircular, whilst those of the adult are very elliptical; and as the anterior part of the latter, as far back as those teeth which have succeeded the temporary, including the incisores, cuspidati, and bicuspidés, is of nearly the same form and size as it had been in childhood, it follows that the elongation must have principally taken place between the situation of the second bicuspidés and the ascending plate in the lower jaw, and between the same teeth and the tubercle in the upper: in other words, that the additional length of the maxillary bones is formed for the reception, and consequently in the situation of the *additional* teeth—the permanent molares, that is to say—posterior to the temporary teeth.

The progress of these changes is now to be described. At the earliest period at which mention has been made of the existence of the dental rudiments, they are found to be arranged with perfect regularity within the jaw; but as ossification advances upon them faster than the jaws expand, they gradually become crowded, and the incisores are placed almost in contact with the molares, in consequence of the cuspidati being thrust, as it were, out of their place. The jaw, however, continues to enlarge, and, at length, allows of the temporary teeth being regularly placed in the gum. But as the permanent teeth advance in their formation, the proportions are again altered, and these are crowded to a still greater degree than the former, and continue to be so to a certain extent during almost the whole period of their growth. Viewing them in this state alone, it would indeed be difficult to imagine by what means they could ever become regularly arranged. It was the opinion of Hunter, in which he was followed by Fox, that the increased size of the permanent incisores, when compared with the temporary, is exactly counterbalanced by the smaller size of the bicuspidetes, compared with the temporary molares which they succeed; and the figures given by both these authors, purporting to exhibit a comparative view of the lower jaw, in different stages of its growth, is so constructed as to favor this opinion to the utmost. It is however impossible, upon the grounds taken by these authors, to reduce this question to any thing like mathematical accuracy; for, as Dr. Blake very justly observes, the arch of a jaw of a year old may even exceed the arch of an adult. It is therefore obvious, that no comparison

instituted between the jaws of different individuals, can be at all conclusive. The only way in which the fact can be ascertained, is by making observations on the same person at different ages, and comparing the arch of the jaw at seven years of age, with the same jaw at twelve or fourteen. This I have repeatedly done, and have no hesitation in saying that the ten anterior permanent teeth occupy a somewhat larger arch than the temporary ones which preceded them had done, and consequently that the view taken by Hunter and Fox, is incorrect, though not to the extent which Dr. Blake and M. Delabarre have supposed. As is often the case, the medium between the two conflicting statements would appear to be nearest the truth. When the permanent incisores therefore have made their appearance, were the cuspidatus immediately to succeed them, it would be impossible that they should ever occupy their regular situation in the arch, because there is not room for them between the incisores and the temporary molares: but as at least one of the latter teeth is shed, before the cuspidatus comes through the gum, and as the bicuspidates occupy less room than their predecessors, the necessary accomodation is, by these two circumstances, ultimately produced in every well proportioned jaw.

OF IRREGULARITY.

There is not a subject connected with that branch of practice, of which the present work professes to treat, which has given rise to such gross charlatanism, or to so much gratuitous cruelty, as that which regards the treatment or prevention of

irregularity in the permanent teeth. Had I only to lay down the general principles upon which cases of this kind are to be treated, they would occupy but little space, for they are few and simple;—but so universally have the practices obtained which I shall have occasion to deprecate, (and which must have originated either in the most culpable ignorance, or in motives more disgraceful still than ignorance itself,) that some examination of the directions of former authors appears necessary, in order to remove, as far as possible, the erroneous impressions which have thus been made. The authority of a writer so respectable as Fox, has had too powerful an influence on those who, from indolence or indecision, are always glad to be saved the trouble of thinking for themselves; whilst the practice which some of his professed followers have adopted on the responsibility of his name, has been such as might indeed have been too surely anticipated, from erroneous principles, acted upon by interested ignorance.

Irregularity, which, in a practical point of view, is only referrible to the adult teeth, may be considered as either temporary or permanent. There are two kinds of temporary irregularity:—the first occurs from the want of concert between the absorption of the temporary and the advance of the permanent teeth, by which the latter are forced into an unnatural position, and come through the gum, either before or behind the former; the second arises from the difference in size between the temporary and permanent incisores and cuspidati, and is subsequently obviated by the loss of the temporary molares, when succeeded by the bicuspidates, which are smaller, and which consequently

allow of the necessary increase of room in the front of the mouth. Permanent irregularity originates in the want of exact proportion in the extent of the maxillary arch, and the size of the permanent teeth. That which I have called temporary irregularity also assumes a permanent character, when the irregular teeth have remained so long unattended to, as to have become fixed in their unnatural situation, or are retained in it, by the pressure of the antagonist teeth in the other jaw. Malformations of the jaw and the occurrence of supernumerary teeth, are also occasional causes of permanent irregularity.

OBSERVATIONS ON THE PRETENDED PRESERVATION OF
IRREGULARITY.

The directions given by Mr. Fox, and adopted by other authors, for the prevention of irregularity, have, as was before observed, for a long time formed the basis of the established practice of dentists, in their treatment of the mouth in childhood; and this circumstance, when the injurious consequences which must follow their adoption are considered, renders it necessary to examine them with attention, both as to the existence of the evil which they profess to obviate, their efficiency in producing this effect, and the consequences which too often result from their employment. The following paragraph contains in a few words, the ground of the practice which he subsequently details.—“To assist the permanent teeth in acquiring their proper arrangement, the mouth should be examined from time to time, that the operation be performed at the time required; *for it is not sufficient to re-*

move an obstructing tooth, when the new one is perceived to be coming irregularly; because, it always requires a considerable time to bring the latter into its proper place, and often the irregularity remains unaltered." Afterwards the following passages occur.—"Sometimes the absorption of the fangs of the temporary teeth goes on so slowly, that they do not get loose previous to the passing of the new tooth through the gums behind them. If, then, the permanent molares have been cut for some time, and there be a fulness of the gums behind the under permanent incisores, it will be expedient that the two central incisores be extracted immediately, *although not yet loose.*"—"It will soon be seen as the new teeth arise whether they have sufficient room; if not, it will be necessary to remove the temporary lateral incisores." The observations on all the other teeth are a mere repetition of these directions, which will not, therefore, require quotation.*

It were well if the intentions of nature were

* The following remarks of Mons. Delabarre on this subject, are equally temperate and judicious.—"Le savant professeur Desgenettes a dit des gens toujours prêts à donner des drogues, '*Que les medecins sont plus necessaires aujourd'hui pour les defendre que pour les ordonner.*' Il en est de même des *dentistes* et *parens* des enfans qui sont toujours disposés à sacrifier les dents temporaires, sous le plus léger prétexte. Les difformités qui en resultent ne sont point attribuées à cette pratique; on les met sur la compte du peu de largeur supposé des machoires; de sort que des praticiens, d'ailleurs très distingués, commettent chaque jour les mêmes fautes, de la meilleure foi du monde. Quoi qu'il en soit, la nature qui tend toujours à rétablir l'ordre troublé accidentellement, régularise quel quefois la denture des enfans, malgré les defectueuses manœuvres du dentiste."—*Seconde Dentition*, p. 129.

more attended to in the regulation of the teeth, than has generally been the case. In this, as in every other circumstance in which surgical treatment is required, it should be recollected, that the legitimate object of the surgeon is confined to the application of remedies in disease, or the regulation of the natural functions when they are deranged ; and it is not to be supposed that a process of so much consequence to the comfort and health, and essentially connected with a function so important as that of digestion, should be so imperfectly provided for as to be constantly in need of such harsh and unnatural interference. I have known no less than eight, and even ten firm teeth forcibly removed from the jaws of a child at once. I will not employ the terms of indignation and disgust which such barbarous quackery deserves ; but surely the unnecessary infliction of pain, upon the plea of preventing an evil, which, in the majority of instances there is not the slightest reason to apprehend, and which, even where it might occur, can always be detected in time to obviate it, is of sufficient importance to deserve reprobation even were this the only injury which could result from the treatment recommended in the foregoing passages. —But there are other and more important reasons for avoiding the early removal of the deciduous teeth. It will be remembered, that the connexion between the temporary tooth and the succeeding permanent one continues to exist by means of the cord extending from the sac of the latter to the neck of the former, which must be torn through, if the temporary tooth be removed before the sac is absorbed : until, therefore, the secretion of the enamel is perfected, which is not the case until a

short time before the edge of the tooth passes through the gum, the extraction of the temporary tooth may very probably interfere with the healthy and uniform deposition of this substance.

There is yet another evil resulting from this empirical mode of treatment, which has hitherto been unaccountably overlooked, but which should be impressed on the mind of every practitioner to whom the care of the second dentition is intrusted. The temporary teeth, as long as they remain in the sockets, from being arranged in a continuous and even series around the arch of the jaw, tend to preserve its form, and prevent its contracting during the growth of the child, when every part of the body is undergoing continual alteration, in form as well as in size. By the time that these teeth have become loosened, the permanent ones, in their natural course of the change, are ready to fall into their place, and thus the correct form of the jaw is preserved ; but, if the temporary teeth be removed, before the permanent ones are so far advanced as to be ready to occupy their situation, the support of the alveolar processes being thus lost, the arch of the jaw contracts, and when, subsequently, the permanent teeth are fully formed, there is not room for them to range in their proper situation. Thus the operation which was intended to prevent irregularity becomes the cause of its occurrence, and that in its very worst form ; producing a want of accordance between the size of the teeth and that of the jaw. I have seen so many instances in which this result has taken place, that I have perfect confidence in stating the opinion. The case I am about to mention, in which I had an opportunity of tracing all the circumstan-

ces which I have just described, will serve as an illustration.

A fine healthy boy, about seven years of age, whose maxillary arch was ample and well formed, with every appearance of sufficient room for the permanent teeth, was taken to a dentist to have his mouth examined. This person, without a moment's hesitation, and without informing the parent of his intention, placed the child's head under his arm, and instantly removed with great dexterity, eight teeth, *all of which were firm*, nor was there any appearance of an irregular arrangement in the approach of the permanent ones. It was indeed some months before any of the latter made their appearance, by which time the remaining temporary ones on each side had approached each other, and contracted the space between them. The consequence was, that the teeth were, ultimately, so irregular from want of room, as to require the loss of four of the permanent ones, namely, the first bicuspid on each side, both in the upper and lower jaw, to allow of their acquiring their proper and regular situation. It is to be remarked, that the other children of the same family, and they all greatly resembled each other, were not subjected to similar treatment, but nature was suffered to proceed in her own way, with very little assistance; and in no one of them is there the slightest irregularity.

A favorable prognosis may, with tolerable certainty, be formed of the ultimate regularity of the teeth, as far as it depends upon the relative pro-

portions between them and the maxillary bones, where the following circumstances are found to exist at the period when the second dentition commences: 1st. If the maxillary arch be well formed, sufficiently expanded, and of a semi-circular form rather than elliptical. 2d. If the temporary teeth, although broad, are a little separated from each other; especially if, having been originally somewhat crowded, they have been gradually acquiring more room during the last year or two; as this indicates a disposition in the jaws to expand. 3d. If the first permanent molares appear to be well formed and of moderate size. 4th. If there be no considerable prominence of the gum behind the temporary teeth, indicating that the permanent ones are advancing in that situation. 5th. If the parents, and family in general, especially those whom the child most resembles, have the maxillary arch broad and well formed, and the teeth regularly arranged. In proportion to the degree in which these circumstances exist, a more or less regular state of the teeth may be anticipated.

The following general rules will be found necessary for the regulation of the teeth during their advance. If the inferior permanent central incisors have actually appeared through the gum behind the temporary, the latter, even if they be not yet loosened, may be removed: though I have seldom or never found any ultimate injury to result from leaving them even until the permanent ones had acquired considerable size, unless where the jaw itself has been ill-formed. Should the removal of the two central incisors of the first set be found insufficient to allow of the others coming forward, it is better not immediately to remove the

temporary lateral ones, until the permanent lateral are ready to pierce the gum ; and even if these should in their turn require additional room, the temporary cuspidati should not be hastily removed, as they are of importance in preserving the natural form of the arch, and should therefore be retained as long as possible.

In regulating the incisores of the *upper* jaw, however, more frequent examination, and, often, the earlier extraction of the temporary teeth will be necessary, for the following reasons. It is to be remembered that the teeth of the lower jaw close behind those of the upper when the mouth is shut : when therefore the *lower* incisores come irregularly, as they almost invariably appear behind the temporary,—there is no obstacle in the situation of the upper teeth, to their ultimately assuming their proper arrangement when the temporary impediments are removed : but in the *upper* jaw, if the permanent incisores have made their appearance behind the temporary, and have advanced so far, prior to the removal of the latter, as to fall *behind* the lower ones in closing the mouth, these will of course form a permanent obstacle to their coming forwards into their natural situation. From this circumstance, joined to the great comparative size of the teeth in question, it is frequently necessary, not only that the central, but also the lateral temporary incisores of the upper jaw should be removed. This should, in fact, be done as soon as it can be ascertained, that the permanent central incisores are actually coming through the gum, behind the temporary ; leaving, however, an interval of a few weeks, between the removal of the central and that of the lateral inci-

sores. For the same reasons, the upper temporary cuspidati must, under similar circumstances, be removed when the permanent lateral incisores are appearing behind them, provided that the loss of the temporary lateral incisores have not afforded sufficient room.

As the bicuspidates usually appear before the cuspidati, the loss of the temporary molares, which are larger than their successors, will, in most cases, make room for them and the cuspidati; but if the latter appear first in either jaw, provided the teeth of the other jaw do not present any obstacle, there will be no occasion to remove the temporary molares, until the bicuspidates are ready to emerge through the gum, and it can be ascertained whether the arch of the jaw will be of sufficient extent for the ultimate regular arrangement of the teeth.

From the situation in which the bicuspidates are placed during their formation—that is to say, immediately underneath the bodies of the temporary molares, and encompassed, as it were, by their roots—these teeth seldom assume an irregular position. When, however, this is the case, the lower ones are generally directed inwards towards the tongue, and the upper take a contrary situation, projecting against the cheek. The temporary molares have, in most instances, lost the greater part of their roots before the appearance of the bicuspidates, although perhaps they have not fallen out, or even become much loosened; as they are frequently so firmly wedged between the temporary cuspidati and the first permanent molares, as to form a considerable obstacle to the regular situation of their successors. But whether this be the case or

not, still those teeth should not be hastily removed, as they contribute so much to the preservation of the proper expansion of the jaw, and thus reserve the necessary space for the cuspidati; for it certainly often happens, that in consequence of the too early removal of the temporary teeth, already mentioned—under a mistaken idea that this has been necessary, in order to give room to the permanent—the jaw has been allowed so far to contract, that by the time the permanent incisores and bicuspidates have appeared, the space previously occupied by the whole of the temporary teeth is entirely or nearly filled: and there is not room in the arch for the cuspidati, which are consequently driven out of the line, and project forwards in an unsightly and dangerous position. If, therefore, the temporary molares can, without risking the permanent irregularity of the bicuspidates, be retained until the cuspidati are nearly ready to come through the gum, considerable advantage will be gained by it.

In all these circumstances, much must, of course, be left to the judgment of the operator, in deciding what may be required by the peculiarities of each individual case: the simple and uniform principle is to leave the temporary teeth as long as may be, without risking the permanent irregularity of their successors: in other words, rather to assist nature where she requires assistance, than to do unnecessary violence to her plans.

The only author, whose views appear to me to be at all correct on this subject, is Monsieur Delabarre. Few men can have had the opportunities which he has possessed of realizing the truth of his opinions by observation, and, certainly, no one

could have deduced from it more rational and judicious principles of treatment. It will not, I hope, be considered as evincing an overweening regard to my own opinions, if I acknowledge the gratification which I derived from finding that the principles upon which I had acted in the regulation of the second dentition, for many years before I had perused his work, were, in almost every circumstance, identical with those which that author has advocated ; and I have great pleasure in acknowledging the advantage which I have received from his book.

OF PERMANENT IRREGULARITY.

The natural periods and order in which the teeth are usually changed, and which have already been detailed, are rarely accompanied by any deviation from their regular arrangement, either considerable in its degree or permanent in its duration, provided there be no want of congruity between the size of the teeth and the expansion of the jaw. Now and then, however, when the shedding of any of the temporary teeth has been so much retarded, as that the permanent ones are not only forced out of their situation, but retained there by teeth of the other jaw acting upon them whenever the mouth is closed, irregularity of a very obstinate kind is produced. Still, the most usual cause of permanent irregularity is the actual want of sufficient room in the jaw for the ultimate regular arrangement of the teeth ; and this may occur either from disproportionate narrowness of the jaw, (whether from original formation, or produced by the too early removal of the temporary teeth,) or from a

preternatural size of the permanent. The former is incomparably the most frequent.

The principles upon which both the species of irregularity just described are to be treated, are generally similar ; the only difference is, that their application to those cases, in which the jaws close in such a way as that the teeth of the one prevent those of the other from being brought into their proper place, must be rendered effectual by obviating that interference, which is to be done either by the actual removal of the interfering tooth, or, which is more generally called for, by temporarily preventing the mouth from being closed, by means hereafter to be described, until the regular arrangement is established. I shall first consider generally the more common cases, without regard to this interference. Those cases in which the irregularity is thus complicated will require a separate consideration.

As the incisores and bicuspidés are generally arranged before the cuspidati appear, the latter are those which are most frequently irregular : and when they are so, they almost always project before the others. Sometimes, however, the incisores or bicuspidés are also thrown out of their natural rank. If the irregularity be very slight, and the want of space trifling, it will be sufficient to pass a very thin file between several of the teeth, so as not to deprive any one of them of the whole thickness of the enamel, and in this way a considerable space will be gained by the approximation of all the teeth so treated, and the irregular tooth be brought into its place by moderate pressure ; but if the want of space be so great as to afford no hope of its being remedied by this mode, it often becomes

necessary to sacrifice one of the permanent teeth. It cannot be too strongly insisted on that sufficient time, and every possible encouragement should be afforded, to allow of the expansion of the maxillary arch, before either of these operations is had recourse to; and I have often had reason to congratulate myself, upon the result of having refrained from employing them, until the age of fourteen or fifteen years should have decided whether they would be ultimately necessary; at which period the arch of the jaw has been found to have expanded sufficiently to admit the irregular tooth into its place. It was the custom before Mr. Fox's work appeared, to remove the irregular tooth itself; but as the incisores and cuspidati are of far superior importance to the bicuspidates, and as any partial vacancy which may remain is of much greater consequence near the front of the mouth than farther back, it is much better in all common cases to sacrifice one of the latter teeth, excepting in particular instances, which will be hereafter detailed.

As a general rule, it may also be observed, that in case of the early decay of a first permanent molaris, it will be proper to remove it if there should appear to be a want of room in the jaw, as the bicuspidates will then be allowed to fall back, and give sufficient space for the other teeth to come into their natural and regular situation. This, however, like all the other operations for remedying or preventing irregularity, should not be employed, until the advance of the teeth in the front, indicates an absolute tendency to an irregular position.

If, after a lapse of that period, during which the expansion of the jaw may have been expected to take place, an inferior incisor should be so forced out

of its situation, as that the filing of the neighboring teeth would prove insufficient to afford room enough, it will generally be necessary to remove the irregular tooth itself; after which the others will approximate so as to close the vacancy, provided the teeth of the upper jaw do not interfere with this process. In the upper jaw, however, the removal of a central incisor would be too great a sacrifice; and it never, or scarcely ever happens, that such a step can possibly be necessary. The loss of a bicuspid, or at the worst, of a lateral incisor, though the latter may almost always be avoided, will be found sufficient.

The upper jaw is not unfrequently so much narrowed as to occasion, together with a contracted and deeply excavated palate, a considerable and unsightly projection of the front teeth, and a corresponding deformity of the upper lip. The lower teeth do not, in such a case, come in contact with the upper, and the incisores of both jaws are consequently rendered useless. The loss of either one or both of the first bicuspides, according to the degree of contraction, will generally permit the incisores to assume a more square and natural position.

When any of the superior incisores are placed farther back than their natural situation, and have continued to grow thus until the corresponding lower teeth shut before them, when the mouth is closed—so as to render the irregularity permanent, a different and more complicated mode of treatment is required. It is obvious, that as long as the lower teeth are continually closing in front of the irregular upper ones, it will be impos-

sible to bring the latter forwards. The indications in such cases therefore are, first, to prevent the pressure of the lower teeth; secondly, to remove any other obstacle which may exist in the arrangement of the neighboring teeth of the same jaw; and thirdly, to apply to the irregular teeth a continued force, in the direction of their natural position. Many plans, of various degrees of merit, have been recommended, for the purpose of effecting these objects, some of which have been inapplicable, from the complicated nature of the instruments to be applied. I shall, however, enumerate very few of them, and explain more particularly that which I have found the best adapted to ensure success. Mr. Fox's plan consisted in the application of a bar of gold to the dental arch, extending to the first temporary molaris on each side, having holes for the passage of silk ligatures, by which it was fastened to those teeth in such a manner, as, if possible, not to require removal during the progress of the cure. A ligature was also passed through the two holes opposite to the irregular tooth, which, being carried round its neck, was drawn very tight, and tied in front of the bar. This ligature was directed to be renewed very frequently. In addition to this bar, the object of which was to apply the necessary force to bring the irregular tooth forwards, a square flat piece of ivory was interposed between the molares of the upper and lower jaw, and attached by a small perpendicular piece of gold to the bar by means of rivets, for the purpose of preventing the closing of the lower teeth in front of the irregular upper ones.

I have been rather particular in describing this

writer's plan, as it forms the basis of that which I shall presently have occasion to recommend, though with some considerable modifications. Other practitioners have adopted a sort of cap, either of ivory, gold, or even lead, to the front teeth of the lower jaw : the thick edge of this is rounded off in the front, in such a manner as to push the back edge of the irregular upper tooth forwards, whenever the mouth is closed. The principle of Mr. Fox's plan, is certainly the most correct, and rational ; though its application, as I have found by experience, is susceptible of considerable improvement.

I will now briefly describe the method which I have, for many years, employed with the greatest success ; premising that, with respect to the age at which I have usually preferred undertaking the treatment of these cases, I differ materially from Mr. Fox. As he directs the bar to be fastened to the *temporary molaris* on each side, we must infer that the age of nine or ten was considered by him, as affording the best opportunity for effecting his purpose : as, at a later period, the absorption of the roots of these teeth would render them but insecure supports, for the exertion of so much force as this operation requires ; and, indeed, he appears to limit the period at which it can be done with any hope of success, to the age which I have found to be the *earliest* that could with propriety, be recommended. He says, “ the time to effect any material alteration in the position of the teeth, is before thirteen or fourteen years of age, *and as much earlier as possible.*” I have, on the contrary, always found the age of from thirteen to fifteen sufficiently early, and, in every respect preferable to a young-

er period, as the bicuspidæ are, by that time, fully formed, and, both by their firmness and their form, offer the best possible support to the bar. I have successfully treated a case of this description, as late as between nineteen and twenty years of age, and in a much shorter time than I had anticipated.

The object of bringing forward the irregular tooth is effected, as in Mr. Fox's plan, by means of a gold bar. Instead, however, of its being quite regular and plane, as represented in his work, it should be accurately stamped to a brass cast of the upper teeth, so as to accommodate it to all the depressions and elevations presented by the series of the teeth, excepting that it should stand a little forwards opposite to the irregular tooth ; at such a distance, in fact, as to allow of its being brought quite into its place before it would come into contact with the bar. This method of forming the bar, by fitting it accurately to the arch of the teeth, contributes very much to its firmness and comfort, and prevents, in a great measure, its interfering with the lip. It should be so long as to extend just beyond the first bicuspid on each side ; two small holes are drilled through it at the part corresponding to each of those teeth—to the irregular one—and, if necessary, to any other to which it may be thought desirable to fasten it for greater security. Ligatures, consisting of strong silk twist, are passed through these holes, the ends of each being brought in front ; and the bar is thus fastened, first of all to the bicuspidæ, and then to the irregular tooth. It is necessary that the ligatures should be applied quite up to the necks of the teeth, or they will slip off ; and they should be drawn very tightly, especially that around the irregular tooth. As this

part of the bar stands forward from the tooth, and as, although strong, it should still be elastic, there will be a constant force acting upon the tooth, tending to bring it forwards.

The closing of the jaws is to be prevented by a method less complicated, and less liable to derangement, as well as firmer and more comfortable to the patient than the one formerly in use. It consists of a simple cap of gold, made to fit, very accurately, to a molar tooth either of the upper or lower jaw ; I have usually found the former the most eligible. The cap should extend as far as the neck of the tooth on each side, and should be accurately adapted to all the irregularities of the surface, by being stamped between a brass cast of the tooth and a hollow cast of lead. It is made of gold, containing such a portion of alloy as to render it hard and elastic. When it is applied, the edges which are adapted to the neck of the tooth are to be bent a little inwards, so that some force is required to press them over the convexity of the crown ; they will then spring into the depression at the neck, and the cap will remain perfectly firm in its situation, if accurately made and properly applied. The thickness of the surface must be sufficient to prevent the lower front teeth from interfering with the operation of bringing the irregular upper one forwards, by means of the bar.

The ligatures should be replaced about every other day, and the bar should be wholly removed whenever this is done, in order to cleanse it ; as it otherwise becomes offensive, and irritates the edges of the gum. The frequent pressure of the finger or thumb, or the application of a piece of soft wood behind the tooth, will considerably accelerate the

effect of the bar. As soon as the tooth is thus brought forwards so far, as that its edge is in the least degree anterior to that of the lower teeth, the *gold cap* should be removed, as the pressure of the latter teeth behind the edge of the irregular one, will then tend, more effectually than any artificial force could possibly do, to perfect the cure. The *bar* may be allowed to remain on a few days longer, to prevent the tooth from regaining its unnatural position.

The method of treatment just described is equally applicable in all the varieties of this kind of irregularity, whether one, two, or more of the incisores be misplaced. It is, however, to be recollected, that the bar must in all cases be formed, as that sufficient space is left between it and *each* of the irregular teeth, to bring them all forwards into their natural position. As it is evident that the counter-pressure of the bar is principally made against the regular teeth, in the front of the mouth—the bicuspidæ, from their situation, serving only to keep the bar steady and firm; it will occasionally be found necessary, when the whole of the upper incisores are the subjects of this form of irregularity, that one or two of them should be brought forwards first; and these, when they have become quite firm in their new situation, may be employed to support a bar for the regulation of the others. Suppose, for instance, that the four incisores of the upper jaw are placed behind the edges of the lower, and it is proposed to apply the bar, first of all, to the two central; it should be so constructed as to fit accurately the surfaces of all the teeth excepting those two, and it will consequently rest against the cuspidati and the *misplaced* lateral incisores.

When, by this means, the object is effected, as far as regards the central incisores, and they have become fixed, a new bar is to be formed to suit this altered state of the jaw, resting against the cuspidati and the *replaced* central incisores; and the lateral will, in their turn, be brought forwards, as before described.

OF SUPERNUMERARY TEETH.

It not unfrequently happens, that the pulp of a temporary tooth, in addition to the rudiment of the permanent one naturally destined to succeed it gives off also a second process, which produces a supernumerary tooth. These abortive formations are very generally irregular in their form, and unsightly in their appearance. They are, as far as my own observation goes, the production of the incisores or molares, though Delabarre speaks of the existence of additional cuspidati, which may probably be referred to the same kind of formation, and be produced by those teeth. They are most commonly found in the upper jaw. Those which are situated at the anterior part of the mouth amongst the incisores, are generally of a conical shape, and have a round, though very irregularly formed root.* In some cases, however, they so nearly resemble the true incisores, that it is impossible to distinguish the natural from the supernumerary tooth. I have seen a case in which there were five incisores in the lower jaw, arranged with the most perfect regularity, and all of them equally well formed. One of these must be considered as a supernumerary tooth, but there was no peculiarity of form or

* Plate VII. fig. 8.

appearance to indicate which of them should be so designated. They are also occasionally found resembling the superior lateral incisors, but I have never seen one which could be mistaken for a superior central incisor. When they occur towards the back part of the mouth they resemble, in some measure, the inferior bicuspid, though of a very imperfect and deformed shape.*

The degree of irregularity which the existence of these teeth produces, is often very great. When they occur behind the superior incisors, which is their most frequent situation, these teeth are thrust forwards by the pressure, and the tongue is so much incommoded by the projection of the supernumerary tooth in the palate, as to produce a material defect in the articulation. It is often exceedingly difficult to extract these teeth when they are so situated. Their conical form, their proximity to the posterior surface of the incisors, and the slope of the anterior part of the palate where it descends to form the alveolar process, render it impossible, in many instances, to obtain a sufficiently firm hold, even with the smallest extracting forceps, until they are so much advanced, as that the whole of the crown has made its way through the bone, and the contraction at the neck offers a hold for the instrument. By this time it usually happens that the deformity of the incisors is so much established, as that, after the extraction of the supernumerary tooth, considerable time, with some mechanical assistance, is requisite to replace the protruded teeth in their natural situation. It is, however, necessary, in having recourse to any mechanical force for this purpose, to be exceedingly

* Plate VIII. fig. 9.

careful not to loosen the teeth to which such pressure is applied, as the removal of the supernumerary one must materially weaken the support on that side, towards the palate. The pressure should therefore be very gradual, and, if at any time the teeth appear to be at all loosened by it, should be discontinued for a time, and renewed only as they again become firm. It is very rarely necessary to adopt any other plan to effect this object, than the frequent and moderate application of the finger to the front of the irregular tooth.

The removal of these teeth I have found to be best effected, by a very small pair of straight extracting forceps, with the beaks as slender as can consist with the requisite degree of strength, and with only a slight degree of curvature. This form is certainly the best accommodated to the contracted space for the operation, and can be applied at an earlier period than the thick forceps in general use. It is useless, in most cases, to attempt the extraction of such teeth, while the neck is yet concealed within the bone; and it often happens that an operator, not being sufficiently aware of their form, finding that the instrument is not readily fixed, applies it with so much force, as to shatter to pieces the crown of the tooth, which is very brittle, and thus renders very difficult the subsequent removal of the root.

In almost all cases, in which the existence of supernumerary teeth occasions irregularity of the others, in any part of the mouth, the removal of the former is necessary, and must be effected at as early a period as possible. The directions which have already been given for the remedy of general ir-

regularity, will sufficiently point out such after-treatment as each individual case may require*.

* Occasional remarkable deviations take place in the situation and direction of the teeth, independent of any of the usual causes of irregularity. These, however, are so entirely anomalous, that there can be no practical utility in entering into a detail of them, nor do they appear to possess any interest in a physiological point of view. Amongst the most curious of these deviations is one which forms the subject of a drawing in my possession, in which a cuspidatus, or a supernumerary tooth resembling it, has taken a reversed direction, and appears with its crown directed upwards, projecting into the right nostril, to the extent of three quarters of an inch. The only account I have of the subject, is an endorsement of the drawing, purporting, that it was taken from a skull in the possession of Mr. Smith, surgeon, of Bristol. I have had no opportunity of obtaining farther information respecting it.

OF

THE OSSEUS UNION OF TEETH.

THE intimate and inseparable connexion of two teeth, by means of a true bony union of their roots and sides, though not a frequent occurrence, is too well established by facts, to admit of a moment's doubt. I have met with four instances of it in my own practice, in three of which the temporary superior central incisors were the subjects of this connexion. There are also several interesting specimens of it in the collection at Guy's Hospital, some of which are figured in Mr. Fox's work. There is no reason to suppose that this union ever takes place after the formation of the teeth has been completed, by the disposition of new bone upon the parts in apposition: in some cases, as in the central incisors, it may doubtless be produced by the original union of the two pulps, previous to the production of bone upon their surface; but, in others, where those teeth are found united, the pulps of which were not strictly contemporary with each other—as in the union of a bicuspid with a molaris—the connexion must have been formed during the progress of their ossification.

This deviation from the natural condition of the teeth cannot, unfortunately, be known by any peculiarity in their form or position whilst they exist in the jaw; and it is only by the lamentable

result of an attempt to extract a tooth so circumstanced, that it can be ascertained ; for it is obvious that such an operation must be attended, either by the removal of both, or by the fracture of one of them. The case, however, is of extremely rare occurrence, and we must attribute most of the instances which are related, either to a want of discrimination on the one hand, or, on the other, to an attempt to excuse an ill-performed operation.*

* As this bony connexion of two teeth is a purely accidental occurrence, and unconnected with any other circumstance of a practical nature, than that which I have mentioned, I should not have thought it necessary to enter more into the detail of the cases I have enumerated above, or to endeavor farther to establish their truth than by my own assertion of their having occurred, were it not for an extraordinary attempt which has lately been made, to deny the existence of such cases, and to throw more than doubt upon the veracity of Mr. Fox's statements. I allude to the following passage.

"For my own part I must declare, that during *all* my practice for many years, I have never been able to obtain ocular demonstration of such a fact, or, to satisfy myself that there ever has been such a case. And this I say, also, of all my professional brethren with whom I have had an opportunity to converse on the subject. I hope, therefore, that my scepticism on this point will not be construed into a want of becoming respect for the authorities from which these cases are derived. There is no other way of accounting for such doctrine, than by attributing it to a weak credulity, or love of the marvellous, *or a desire to impose upon the world.* Let us take into consideration one of these cases. Mr. Joseph Fox mentions an instance of this supposed union in two central incisors of the upper jaw at their contiguous sides."

Then follow some observations on the probabilities of the case, which do not bear upon the point I am now discussing. The author then proceeds :—

"I indeed believe that Mr. Fox *did not himself see the case he thus describes*, else he would assuredly have given a more

circumstantial account of it. Such cases furnish a fine apology to ignorant operators, and I have no doubt that the first case of this kind originated in some bungling accident or ingenious deception," &c.—*Koecker's Dental Surgery*, p. 319.

The character of Mr. Fox happily stands too high in professional estimation, to require any labored defence on my part; and an attempt to impugn the veracity of a man whose character was almost proverbial for simplicity and truth, can but recoil with redoubled force upon his accuser. I waive the circumstance that this attack is made on one who is no longer living to rebut the charge, for it fortunately happens that some of the identical specimens from which Mr. Fox's descriptions and figures were taken, are, at the present moment, in the museum at Guy's Hospital, and have been constantly exhibited in my lectures on the teeth, in the theatre of that school, for the last ten years. Mr. Fox has figured three of these cases, though the author in question has quoted but one, and that, certainly, the only one which, from its character and appearance *as figured*, could admit of a cavil. I can, however, vouch for the correctness of this as well as of the others, and without hesitation assert that they are true, undeniable instances of the bony union of teeth.

With regard to the assurance, that "in *all* his practice for many years, the author has never been able to meet with ocular demonstration of such a fact," it really amounts to nothing; but when he declares that "all his professional brethren with whom he has had an opportunity to converse on the subject," have been similarly circumstanced in this respect, I fell myself called upon to remind that gentleman of the following facts which, in the course of years, have undoubtedly passed from his memory.

Mr. Koecker will perhaps remember that, on a temporary visit to England, he did me the honor to call on me, with an introductory letter from a gentleman of the highest eminence in the profession; and that, in consequence of that introduction, I had the pleasure of showing him my collection of preparations, illustrative of the anatomy and diseases of the teeth, at Guy's hospital, the major part of which had been collected by Mr. Joseph Fox; and that amongst those which then occupied our attention, were *the very specimens* to which I have just alluded. I am quite sure that had Mr. Koecker recollected this circumstance, he would have had the candor to omit the passage

which I have quoted ; and I trust that my motive in having endeavored to elucidate the question, will be appreciated as originating only in a sense of justice, and an anxious desire to rescue deceased worth and talent from posthumous misrepresentation.

OF THE
SUPPOSED OCCURRENCE OF A THIRD
SET OF TEETH.

THE question whether a third set of teeth, or, in fact, a second succession of any of the teeth, ever takes place, still appears to admit of considerable doubt. That many cases have existed, in which, at an advanced age, several teeth have unexpectedly made their appearance through the gum, cannot be disputed. I have myself known an instance in which four front teeth were produced in a female at the age of eighty, and there are many other recorded facts of the same kind ; but it may be questioned whether these teeth are to be considered as new formations, or only as the retarded completion of certain of the second set, the progress of which had been suspended, until, upon the loss of the whole of the teeth which had existed during the adult period of life, they received a fresh impulse of formation, by one of those remarkable efforts at renovation which are frequently seen to take place, when the functions of the system have, in their natural course of decay, in a great degree ceased to exert themselves. In support of the latter opinion, to which I confess myself disposed to incline as the more probable of the two, it may be observed that the *dentes sapientiæ* have been, occasionally known, to remain concealed in the jaw, until an advanced period of life ; an

instance of which has occurred within my own observation, where they came through the gum at the age of sixty-five. Besides, it would be difficult to imagine in what manner or upon what known principle of animal formation, the rudiments of these teeth could have been spontaneously formed in the jaw of an old person, as we find that the first set of teeth, which alone can be considered as original and independent in their mode of production, are only formed simultaneously with the original organization of the other animal structures; and that the second set derive their existence essentially from the former. The advocates of an hypothesis already alluded to in a former part of this work, that the teeth are mere appendages to the cuticular system, have advanced the fact of the late appearance of new teeth, as an argument in its favor; but until they can prove that the opinion just stated is incorrect, and that these untimely productions are a new and independent formation—independent at least as it regards the former teeth—it is begging the question to press the fact of their occasional occurrence, into the support of the hypothesis.

The question can only be decided by the observation of cases, in which an accurate knowledge can be obtained relative to the state of the second set of teeth, previously to their loss; particularly whether any of these had been originally wanting, and, if so, in what class of the teeth the deficiency existed. Should it appear that the teeth which were produced in old age corresponded in form and character, with the class in which the former deficiency had occurred, it would go far to prove the correctness of the opinion I have advanced.

The question is, after all, rather one of curiosity in a physiological point of view, than of any practical utility, for these teeth being unsupported by alveolar processes, are always loose and useless, and generally excite so much irritation as to require their speedy removal.

PART THE SECOND.

THE

DISEASES OF THE TEETH.

&c.

THE

DISEASES OF THE TEETH.

THE confusion and misunderstanding which have generally prevailed respecting the diseases of the teeth, have arisen from two opposite errors. On the one hand, those who have denied the organization of these bodies, have, consistently enough, supposed them to be wholly unsusceptible of disease properly so called; whilst, on the other, those who have maintained the identity of their structure with that of the bones, have been led to view the morbid affections of both in exactly the same light, and to apply to them indiscriminately the same terms. Into the latter of these errors Mr. Fox, who first attempted to assign distinct terms to the diseases of the teeth, appears to have fallen; an error which though infinitely less mischievous than the former, has still been productive of very false notions, and of much mistaken treatment. The application, to the diseases of the teeth, of the names which had long been in use to designate those of the other bones, has not only misled the profession generally who have adopted the views of the author I have just mentioned, but, in all probability, had no inconsiderable influence

on that gentleman himself, who, pleased and satisfied with the specious simplicity which characterized such an arrangement, appears not to have perceived the inconsistency into which his favorite idea occasionally led him. The fact is, that he who denies the analogy between the structure of the teeth and that of the bones, and he who shuts his eyes against the minor points of distinction which actually exist between them, are alike mistaken in theory, and alike liable to error in practice.

The principle which I have insisted on throughout the former part of this work, respecting the peculiarities which exist in the organization of the teeth, I believe to be the only one which will explain the true nature of their diseases, and account for the apparent anomalies by which they are characterized. With a view to the present subject, that principle may be thus stated:—*Although from the identity of structure in the teeth and in the bones, they are obnoxious to similar causes of disease, yet the phenomena which the teeth present in disease are so modified by the lower grade of their organization, and the less active condition of their living powers, as, in many cases, to exhibit characters essentially different from those which belong to the analogous diseases as occurring in the bones.*

In addition to this more important and obvious cause of the discrepancies referred to, the uniform density of their substance, the total absence of a cancellated structure, and the peculiarity of their situation—a considerable portion of each tooth being exposed to external causes of disease, protected only by a layer of inorganic matter—must all

act as so many additional means of producing considerable modification in the characters of their diseases.

The object of these remarks is rather to prevent future mistakes of a similar kind, than to introduce any considerable alteration in the names already assigned to the diseases of the teeth. Custom, and the authority of the profession, have so long and so universally sanctioned some of them, that greater inconvenience would probably arise from the change, than from the retention of terms which every one comprehends, but which may not perhaps be entirely free from objection. In some instances, however, the absurdity of the names formerly used, and the necessity of distinguishing diseases which had previously been confounded, will necessarily call for the introduction of terms not before applied to diseases of teeth.

OF
GANGRENE OF THE TEETH, COM-
MONLY CALLED CARIES.

THE most common disease to which the teeth are liable, is that which has hitherto been universally known under the name of *caries*; a name which, although authorized both by English and continental writers, is, in this instance, totally misapplied. It is, in fact, calculated essentially to mislead, as the disease has not the slightest analogy to true caries of bone. The perpetuation of so obvious an error as this, is surely more than the most fastidious opponent of innovation could require: I propose, therefore, to substitute for it the term GANGRENE of the teeth, a word which expresses the real nature of the disease.

It may be defined, *mortification of any part of a tooth, producing gradual decomposition of its substance*. The latter clause of the definition is not perhaps essential, but it expresses the invariable condition of the disease, as it exists in the teeth.

It usually attacks the crown of the tooth; sometimes, though rarely, the neck; but I believe it scarcely ever makes its first appearance on the root. It invariably shows itself on the external surface of the bone, immediately underneath the enamel, and its existence is, in many cases, first indicated by an opake spot on that substance, occasioned by partial breaking down of its crystalline structure: in others, its presence is

shown by the discolored bone being seen through the semi-transparency of the enamel. If at this stage of the disease the tooth be sawn through at that part, so as to intersect its centre, a brown mark will be found in the bone, immediately under the opaque spot of the enamel, extending more or less into the substance of the tooth, in a line tending directly towards the cavity : it is darkest at the surface, where, from the disease having commenced at that part, its progress is more advanced, becoming gradually lighter towards the centre.*

When a superficial portion of enamel is removed from over the decaying spot, in this incipient stage of gangrene, the mark is still seen in the substance of the enamel ; and, from its darkened hue, and the obvious loss of continuity in its texture, it would convey the impression that the disease must have commenced in the enamel itself. This appearance has undoubtedly tended to confirm those who have taken but a *prima facie* view of the subject, of the truth of that opinion ; but it may be satisfactorily accounted for, in perfect accordance with the theory which I have advanced of its true situation and cause, if we consider the peculiar structure of this substance, and its relation to the bone of the tooth. It will be recollected that the enamel is crystalline : that the crystals are parallel to each other, and perpendicular to the surface of the tooth. From this arrangement, it is obvious that the most solid and continuous support is necessary to preserve them from becoming displaced, and losing that perfect unity of structure upon which the strength of this substance mainly depends. Hence, it follows

* Plate IX. fig. 1, 2.

that on the removal or softening of the smallest portion of the bone of the tooth, immediately under the enamel, and on which the terminations of the crystals had rested, they will in some measure, give way ; and this, though not to such a degree as at first to exhibit any obvious displacement, yet sufficiently to show the diminution of their cohesion, by the loss of that semi-transparency, and that perfect integrity of texture, which characterize a sound and healthy condition of the enamel.

Commencing in the manner just described, the mortification continues insidiously to increase, and destruction of the substance of the bone soon takes place, still preserving the same direction from the surface to the centre ; it becomes blackish and softened, and at length the enamel, having lost its support, breaks away, and suddenly discovers a cavity, which, perhaps, had not previously been suspected to exist. When the disease has proceeded so far, as that the internal cavity is either actually exposed, or covered only by a softened portion of the bone, inflammation of the membrane often takes place, either from exposure, or from the pressure of food, and produces that "hell o' a' diseases," as Burns, with his accustomed emphasis, expresses it—the tooth-ache.

Thus by the continued progress of the disease, portion after portion is removed, until the whole of the crown is destroyed, and the roots remain dead extraneous bodies in the sockets. Here the progress of the gangrene often seems to be arrested ; for the membrane being destroyed, and the roots having lost their vitality, they are no longer the subject of disease, and often continue for years, in

nearly the same apparent state ; affording, in many cases, a continued support to the next teeth and alveolar processes. At other times, however, and particularly in irritable constitutions, a slight cold, the excitement of mercurial medicines, indigestion, or some other cause, will occasion a greater or less degree of irritation in the socket, followed in some cases by abscess in the alveolus, caries of the bone, or the formation of tumors of various characters ; in others attended with very painful sympathetic affections very nearly resembling *tic douloureux*.

In some cases it happens that the teeth become so gradually decayed, that instead of the membrane being soon exposed, and tooth-ache consequently produced, it becomes absorbed before the decay reaches the cavity, and the tooth breaks away without ever having occasioned pain. This peculiarity appears to depend upon some cause connected with the original structure of the teeth, as I have often known an individual lose a great number of teeth in this way, without ever having suffered tooth-ache.

When the roots are, by the advance of gangrene, rendered mere extraneous bodies in the alveoli, three different actions are set up to effect their removal. In the first place, absorption of the alveoli and gums occurs to such an extent, as gradually to loosen the roots, by depriving them of their support. At the same time, also, a deposition of bone takes place at the bottom of the socket, which, by degrees, forces the root into the substance of the gum, until it may often be seen lying horizontally, imbedded in that substance, without any attachment to the bone, or the slightest lodgment in the socket ; and in the third place,

the roots themselves undergo absorption at their extremities, so that at length a very small portion only is, in many cases, found to remain.

This I have sometimes seen occur to such an extent, that the whole of the crown being destroyed by decomposition, and the root removed by absorption, nothing but a portion of the neck remains attached to the gum. In the case of which a figure is here given,* the *dens sapientiæ* had become the subject of this double destruction of substance, so that only a small, though perfect, ring of bone was preserved.

OF THE CAUSE OF GANGRENE IN THE TEETH.

Mr. Hunter approached as near to a correct opinion on the true nature of this disease, as it was possible for him to do, with the confused notions which he entertained on the vitality of the teeth. He calls it "such a decay as would appear to deserve the name of mortification. But," he continues, "there is something more; for the simple death of the part would produce but little effect, as we find that teeth are not liable to putrefaction after death, and therefore I am apt to suspect, that, during life, there is some operation going on which produces a change in the diseased part."† This passage is deserving of attention, as the fact to which it refers, will be found of importance in forming a conclusion on the nature of the disease.

It is, I believe, only by recurring to the vitality of the teeth, modified as it certainly is by the

* Plate IX. fig. 3.

† Nat. Hist. of the Teeth, p. 135.

peculiarities of their structure, that we can arrive at the true explanation of the nature, the cause, and the progress of dental gangrene. Mr. Fox, apparently from his well intended, but overweening fondness for discovering in the diseases of the teeth a perfect analogy with those of other bones, was led to form incorrect notions on this subject, though it is to him that we are indebted for the actual discovery of the cause of this disease. He says,* “when the membrane becomes inflamed, it separates from the bone, and the death of the tooth is the consequence. That this is the proximate cause of caries,” he continues, “appears to be highly probable, by remarking that a caries of other bones is caused by a separation of those membranes which cover them, and which are attached to them. Thus a separation of the periosteum will cause a death of part of the *tibia*; or that of the *pericranium*, a caries of some of the bones of the head.” Exclusive of the circumstance that caries is, in this passage, confounded with necrosis, it contains, in every respect, a false view of the question. It is extraordinary that this author, arriving, as he did, at so near an approximation to the true cause of the disease, should have at once confounded not only caries with gangrene, but partial gangrene with the total death of the tooth. If inflammation go on to such an extent as to occasion the separation of the membrane—the loss of the medium of organic communication between the tooth and the general system—the whole tooth loses its vitality at once, and becomes an extraneous body in the socket; under

* Diseases of the Teeth, p. 13.

which circumstances, it indeed gradually assumes a darkened color, but without any of those appearances which characterize the disease in question.

Still, however, the true proximate cause of dental gangrene is inflammation; and the following appears to me to be the manner in which it takes place: when, from cold or from any other cause, a tooth becomes inflamed, the part which suffers the most severely is unable, from its possessing comparatively but a small degree of vital power, to recover from the effects of inflammation; and mortification of that part is the consequence. That the bony structure of the teeth is *liable* to inflammation, appears not only from the identity of the symptoms which take place in them when exposed to causes likely to produce it, with those which are observed in the other bones when inflamed, but more conclusively still from the fact already mentioned, that teeth are occasionally found in which distinct patches, injected with the red particles, of blood, have been produced by this cause, after the continuance of severe pain. A tooth which has been the subject of inflammation, will often remain without any diseased appearance, for weeks or months afterwards; but at length the consequences which I have described become obvious, by the occurrence of a darkened spot which shows itself through the enamel; and the gradual destruction of the tooth follows, if means be not taken to arrest its progress. I have known a case in which inflammation had taken place through all the molars of one side; both above and below; and, notwithstanding it was speedily subdued by leeches, &c. yet within a year afterwards, scarcely any of the teeth so affected had escaped the attacks of

gangrene, although the corresponding teeth on the other side remained free from disease.

The situation in which gangrene invariably makes its first appearance, immediately under the enamel upon the surface of the bone, is, I think, explicable only with the view I have taken of the structure of the teeth and the nature of this disease. As the vessels and nerves which supply the bone of the teeth, are principally derived from the internal membrane, it is natural to conclude, that, in so dense a structure, the organization would be less perfect in those parts which are farthest removed from its source ; and that, in the same proportion, they would be less capable of resisting the progress of mortification ; as we find that those parts of the body which are farthest removed from the source of circulation, are more particularly prone to gangrene and other diseases which arise from want of activity in the sanguiferous system. On the other hand, the roots of the teeth, which are not only supplied by vessels from the internal membrane, but are also furnished with a periosteum, may be rationally supposed to be more perfectly organized,* and we consequently find them capable of resisting disease much longer than the crown.

The continued and invariable progress of dental gangrene is only to be accounted for by following up the same reasoning. When a portion of any of the other bones loses its vitality, it acts as an extraneous body, producing irritation in the surrounding parts, and a process of absorption is

* A reference to their chemical composition will show that the roots possess a greater proportion of animal matter than the crown.

set up in a line of living bone in contact with it, in order to effect its separation. A similar effort appears to me to be made in a gangrene of the teeth, but with a very different result, in accordance with the difference in the structure of the two seats of the disease. When a portion of a tooth is killed by inflammation, it excites, as in the other case, an increased action in the vessels of the surrounding portion of bone; but that very action, which, in such bones as possess greater vital power, becomes remedial by promoting the removal of the cause of irritation, produces in the present case the continued extension of the disease: for the irritation thus excited, instead of effecting the removal of the part by absorption, as in other necrosed bones, at once destroys its vitality, and renders it only an additional portion of dead matter to that which had already existed. This, in its turn, becomes an extraneous and irritating body to the surrounding bone, in which the same action is set up, and the same mortification produced, and thus portion after portion is successively irritated and killed, until the whole crown of the tooth is destroyed.

It appears then that this disease, in its origin and progress, affords strong collateral evidence in favor of the vitality of the teeth. It has indeed been objected to this theory, that ivory, after remaining long in the mouth, as in the case of artificial teeth, is equally the subject of decay; but any one who has noticed the difference in the appearance of the two decaying substances, will immediately see the fallacy of the objection. When a portion of ivory has been long exposed to the combined action of moisture and heat, the

whole surface becomes soft, and of a brownish color, which goes on increasing, until the whole mass has undergone this change. How different is this general decomposition from the circumscribed outline which characterizes dental gangrene in which the decaying portion is perfectly distinct from the healthy white bone which surrounds it. The different appearances therefore in these two cases, are precisely those which might have been anticipated, from the view which has been taken of this subject; and may be considered as supporting the doctrine, rather than as impugning its consistency.

The supposition, not an uncommon one, that gangrene may arise from merely external causes acting upon the surface of the enamel, cannot but be fallacious, if the foregoing opinions be well founded; and it will be evident that the treatment of the disease must be modified according to the degree of credibility by which they are supported.

OF THE PREDISPOSING AND REMOTE CAUSES OF DENTAL GANGRENE.

By predisposing or constitutional causes, I mean those which are inherent in the original structure and constitution of the teeth, whether hereditary, or induced by circumstances operating during their formation; and by remote causes, I intend those, which, by producing *subsequent* changes in their condition, render them more liable to be acted upon by any of the *exciting* causes of the disease.

Hereditary predisposition is amongst the most common and remarkable of the former class. It often happens that this tendency exists in either the whole, or great part of a family of children, where one of the parents had been similarly affected; and this is true to so great an extent, that I have very commonly seen the same tooth, and even the same part of the tooth, affected in several individuals of the family, and at about the same age. In other instances, where there are many children, amongst whom there exists a distinct division into two portions, some resembling the father, and others the mother, in features and constitution, I have observed the corresponding difference in the teeth, both as it regards their form and texture, and their tendency to decay.

The whole list of infantile diseases, operating during the formation of the permanent teeth, are to be considered as so many causes predisposing to gangrene; as the irritation excited by the first dentition, for instance, and all the various morbid actions consequent upon it. Not the diseases alone of this period, but some of the remedies also which are employed for their cure, exert a most injurious

influence upon the future constitution of the teeth. The immoderate use of mercury in early infancy, produces, more perhaps than any other similar cause, that universal tendency to decay, which, in many instances, destroys almost every tooth at an early age. It is certainly not unimportant to bear this fact in mind, in the administration of this "sovereign remedy," this panacea, as many appear to consider it, in infantile diseases.

A strumous constitution is very often accompanied by early and general decay of the teeth. I will instance one case, which, however, possesses no claim of peculiarity for its selection. It but too much resembles many others that every practitioner must be acquainted with.

Miss H., a young lady, seventeen years of age, possessing that remarkable transparency of skin, and delicacy of features, which too often indicate incipient consumption, consulted me respecting the state of her teeth. The enamel, where it remained, was of that beautiful pearly whiteness and transparency which characterize teeth of a weak and frail texture, but there was not a single tooth, either in the upper or lower jaw, which was not to a greater or less degree the subject of gangrene. Not one even of the inferior incisores, so seldom attacked by disease, had escaped its ravages.

That morbid affections of the constitution, occurring during the formation of the teeth, produce in them a predisposition to decay, receives a strong confirmation from the fact that in the greater number of cases they become diseased in

pairs ; for in whatever changes the constitution may suffer at that period, the teeth, then in the progress of their formation, would naturally participate ; and would be rendered more or less liable to disease, in proportion to the injury thus inflicted on them. Upon the period therefore at which these constitutional disorders take place, it will, to a certain degree, depend which teeth shall be most predisposed to decay.

Amongst the *remote* causes, or those which produce a deleterious *change* in the constitution of the teeth subsequent to their formation, one of the most extensive in its effects is the use of mercury. As these effects on the teeth and the neighboring parts will form a subject for separate consideration, it is unnecessary here to do more than to mention that it often happens after the lapse of a considerable period subsequent to the constitution having been saturated with mercury, that the teeth begin to evince a general tendency to decay. To the profuse administration of this remedy in tropical diseases we may, I think, in a great measure, attribute the injury which a residence in hot climates so frequently inflicts on the teeth. It must not however be considered as the exclusive, or even the principal source of this evil, for fevers of every kind, dyspepsia, and, in short, every severe or long continued constitutional disorder, must be classed amongst the remote causes of dental gangrene.

OF THE EXCITING CAUSES OF DENTAL GANGRENE.

From the view which has been taken of the na-

ture and proximate cause of this disease, it is evident, that whatever has a tendency to produce inflammation in the teeth, may become an existing cause of it; probably the most frequent of these is any sudden or considerable change of temperature; whether the effect of exposure to a cold atmosphere, or of taking very hot or very cold substances into the mouth. As a general rule it may be observed, that whatever is placed in contact with the teeth, either so much higher or lower than the natural temperature of the body, as to produce pain, may probably prove to be the exciting cause of the disease; thus, drinking very hot fluids on the one hand, and, on the other, taking ice, without the precaution of preventing it from lying in contact with the teeth, are, I am convinced, fertile sources of disease in these organs. When the extremely dense, solid structure of the teeth is considered, it will not appear wonderful that this result should occur from change of temperature in a part, the unyielding nature of which precludes the possibility of expansion and contraction, not only in the vessels of its substance, but also in the membrane filling its cavity.

The exposure of the bony structure of the tooth by the destruction of the enamel, whether the consequence of imperfect formation, of accidental fracture, or, more particularly, of the pressure of the teeth, upon each other, is another exciting cause of that inflammation which terminates in mortification. The latter is a very common circumstance, and is generally the result of a want of sufficient room in the arch of the jaw. It most frequently occurs in the superior incisores, in which, if they are crowded together, mutual pres-

sure takes place to such a degree as to break down the crystalline structure of the enamel at the point of contact, and thus to occasion the exposure of the bone.

It is a general, but very mistaken notion, that one decaying tooth will communicate the disease to another by contact. I have long been of opinion, as will be seen by a reference to the paper before alluded to,* that this is totally inconsistent with fact, with the chemical composition of the teeth, and with the cause of gangrene as already explained. Whatever circumstance could excite inflammation, and consequently produce gangrene in any one tooth, would be equally likely to effect those in immediate connexion with it ; or the mutual pressure of two teeth upon each other may occasion exposure of the bone in both by the breaking down of the enamel ; and, as in either of these causes, one of the teeth, from being more injured, or of a less healthy original structure than the other, would probably evince earlier indications of disease, it might be hastily supposed, when the next tooth showed symptoms of decay, that this had received contamination from the former ; but there can be no chemical agent evolved in the destruction of one tooth, which could possibly occasion the decomposition of another ; nor, as the bone of a perfect tooth is completely protected by the enamel, could any substance of an irritating nature, supposing such to be evolved during the progress of the disease, come in contact with the living portion of the sound tooth.

It appears then that the facts upon which this absurd and most injurious supposition has been

* Med. Chir. Trans. vol. x. p. 44.

founded, may be rationally explained by a reference to other causes than that of contamination. The practical importance of this question is too obvious to require illustration. If the view which I have taken of it be correct, the practice which has so universally obtained of sacrificing teeth which, though partially decayed, might yet have been retained and rendered useful, must be considered as most injurious and unnecessary; and one of the most frequent pleas for their removal is at once taken away. Nothing is more common than for persons to lose many of their teeth, from the persuasion of the dentist that the decay will be communicated to the others, when by a judicious application of the methods hereafter to be explained, of removing the disease, they might for years be rendered available for all the purposes of mastication, &c.

The teeth most liable to mortification are undoubtedly the *dentes sapientiæ*; and I have even known many instances in which, when they first made their appearance through the gum, they were already in a state of partial decay. This probably arises from their being formed at a later period of life than the other teeth, when the constitution is doubtless in a less favorable state for the production of newly formed parts, than during early infancy, when the process of new formation is going on with rapidity in every part of the system. The first molares are also frequently decayed at an early age; so much so that it is often necessary to remove these teeth, in consequence of severe suffering from tooth-ache, even before many others of the permanent set are per-

fect. The cuspidati, both superior and inferior, are comparatively seldom the subjects of disease; and the inferior incisores still more rarely.

Every part of the crown appears to be equally liable to gangrene. In the molares it attacks alike the centre of the masticating surface, the side in contact with the next tooth, and the outer and inner surfaces; the incisores are often carious at the point of contact, and now and then the superior lateral incisores become first decayed at the centre of the posterior surface.

It is generally supposed that there are two distinct kinds of dental gangrene, as it assumes very different appearances in different individuals; being sometimes quite white, at others brown or blackish. These varieties, however, for they are nothing more, depend upon the constitution of the teeth, and the circumstances under which decay has commenced. If the teeth were originally of a delicate texture, formed under a weakly or scrofulous state of the constitution, the progress of the gangrene is generally very rapid, and the decayed part becomes soft and of a whitish color; but if they possess a more dense and firm structure, and were formed in a healthy state of the system, the decay, when it does occur, is much more tardy in its advance, and the affected portion is always of a dark brown or blackish hue. The cause of this difference appears to be, that, in the former case its progress is so rapid that the decomposition is imperfect, and no change of color therefore takes place;—in the latter its advance is so slow as to allow of a more complete decomposition, and the decaying substance consequently becomes more or less darkened.

Whatever tends to irritate and inflame the gum, must in a greater or less degree produce a corresponding irritation in the teeth, from the close connexion which subsists between them ; and hence the accumulation of tartar, portions of food remaining between the teeth, or any similar circumstance, may possibly become an exciting cause of gangrene ; and this, not only by means of inflammation propagated through the gum, but also by the exposure of the necks of the teeth to external agents, in consequence of the absorption of the gum and alveolar processes. The necessity of keeping the teeth in a constant state of cleanliness, and freedom from all extraneous substances, will be particularly insisted upon in another place, but deserves to be alluded to here, as a means of preventing the occurrence of gangrene from the causes just mentioned.

OF THE
PREVENTION OF GANGRENE IN THE
TEETH.

A REVIEW of what has already been said respecting the causes and progress of this disease, will naturally lead to an anticipation of the precautionary treatment which may be recommended for its prevention. It is unnecessary here to allude to those diseases or other injuries which have been mentioned as remote causes of dental gangrene ; but with regard to those which are more under our control, it may be well to lay down some regulations for their avoidance or removal.

In the first place, fluids should never be taken into the mouth, or at least should not be applied to the teeth, either so hot or so cold as to produce the slightest pain ; and, for the same reason, the water with which the mouth is cleansed should, in the winter, be always warm or tepid. When, from any of the causes before mentioned, a certain degree of inflammation is set up in any of the teeth, it should be immediately reduced by the application of leeches to the gum, as near as possible to the part in pain ; and, if necessary, this should be repeated, and the bleeding encouraged by holding warm water in the mouth. It is perhaps seldom that this measure is had recourse to sufficiently early to prevent subsequent injury, either from ignorance or want of attention to the

probable consequences ; but I have no doubt that if the plan now recommended were adopted in an early stage of the inflammation, this result would in very many instances be prevented. As a general rule, leeches should be applied to the gum, whenever pain exists in an apparently sound tooth.

When, from the want of room in the maxillary arch, the teeth are so crowded as to press with considerable force against each other, this pressure should be removed, by passing a very thin file between those which are, in the greatest degree, subjected to it. These will generally be the incisores. As a very small portion only will be required to be removed, the file should be as thin as possible, and exceedingly fine. It is of the utmost consequence that the whole thickness of the enamel should *not* be taken away from either of the teeth between which the file is passed, but that a perfect covering of this substance should still be preserved, to protect the bone from external agents ; and it is never to be forgotten that this operation is only to be had recourse to, as the least of two evils, and therefore requires care and judgment in deciding upon the propriety of its adoption. In the mode of its application also, care must be taken that the force used shall be so regular and moderate, as not to risk the chipping off or fracturing of the enamel. Should a bicuspid, or even a molar tooth be already considerably diseased, it will, in many cases, be sufficient to remove it ; for, by degrees, the other teeth will tend towards the vacancy, so as to take off their mutual pressure upon each other, and thus obviate the necessity of filing.

ON THE

TREATMENT OF DENTAL GANGRENE.

WHEN gangrene has once actually commenced its ravages in a tooth, it is always very doubtful, even in the most favorable cases, whether the causes, whatever they might have been, have not operated so deeply as to prevent the possibility of effectually arresting its progress. In discussing this subject it will be necessary to consider the various modes of treatment which are recommended under different circumstances, and to point out the advantages or disadvantages which they relatively possess. The opinions which I have advanced on the structure of the teeth and the nature of the disease now under consideration, have led to the adoption of such principles of treatment as are, I confess, somewhat at variance with those of many other writers and practitioners in this department of surgery ; but as those opinions are the result of careful and unbiassed investigation, so the practice which I have to recommend as having been founded upon them, has stood the test, the only one to be relied upon, of experience and observation. That the universal charge of empiricism, so lavishly bestowed by some writers upon the practitioners of this branch of the profession, is not wholly deserved, I trust many living examples will bear me out in asserting ;—and it is not unworthy of notice that those who have been most clamorous against the empiri-

cism of others, have not, in all cases, been free from taint :—but that ignorance and quackery have usurped as high a seat, and exercised as sovereign a sway, in this, as in any other department, is a truth, against which, with the examples surrounding us on every side, it is impossible to close our eyes. With this host of opposition, however, I shall not hesitate to cope, satisfied as I am that the principles I have to advocate, are consonant with reason, and supported both by analogy and experience. Let the known truths of physiology and the facts of rational experiment be here, as in other branches of the healing art, the foundation of our theories and the guide of our practice—then, and not till then, will this useful and important object cease to be, what its unworthy professors have too deservedly rendered it, the opprobrium of the medical profession.

In the earliest stage of gangrene at which its existence can be ascertained, when its only indication consists of an opake or darkish spot upon the enamel, and before the subjacent bone has become softened, the careful removal of the diseased spot should, if practicable, be immediately effected. The principle upon which this plan is here recommended, is easily understood by referring to the cause of the progress of the disease, as already explained—namely, the existence of a dead portion of the bone, exciting irritation in the surrounding part with which it is in contact. This operation should be confined, as much as possible, to the excision of the diseased portion exclusively; for it is to be recollected that, at best, it consists but of the substitution of a less evil for a greater—of the ex-

posure of a portion of healthy bone to the contact of the saliva, of the atmosphere, and of food, instead of the excitement of a dead and decomposing portion of its own substance. The free and extensive use of the file, so commonly resorted to for this purpose, cannot therefore be too strongly deprecated. From its form, and the mode of its application, its devastation cannot be restricted to the decaying part of the tooth, but must necessarily remove a much larger portion of the healthy bone, and expose a considerable surface to external causes of decay ; which although under such circumstances very slow in their action, are scarcely less certain than the very agent which this treatment was intended to remove. In this early stage, however, before the enamel has become at all weakened by any softening of the bone beneath it, its structure is, in fact, too hard to yield to any instrument excepting the file ; but it should be used with caution—applied, if possible, only to the discolored portion—and carried no deeper than just to expose the surface of the diseased bone, which is then to be removed by other instruments. If the bone is still very hard, it should be taken away by means of strong steel brooches, having three-sided points, and of various sizes, to correspond with the extent of the disease. These will readily cut away the greater portion of the diseased bone, and its more perfect and accurate excision should then be so completely effected by small cutting instruments of various forms and sizes hereafter to be described, that every particle of discoloration should be removed ; without which, the operation will be ineffectual.

ON THE OPERATION OF FILLING THE CAVITY PRODUCED BY GANGRENE.

When the decay has extended deeper than the state just described, so that its complete removal would leave a circumscribed cavity, it will often be necessary, in addition to this operation, to exclude the subsequent influence of the external causes of its recurrence, by carefully and completely filling the cavity with a substance at once indestructible and not liable to chemical change. When the circumstances of the case are the most favorable for the success of this plan of treatment, and it is judiciously and properly performed, it is in many cases, so perfectly effectual, as permanently to arrest the progress of the disease. Its result will depend upon the form, situation, and extent of the decayed portion—upon the condition of the tooth, both with regard to its original structure and its present health—upon the more or less complete excision of the gangrened part—the substance employed in the operation—and the evenness and solidity with which it is pressed into the tooth.

The decayed part should be small and circumscribed, so that when it is wholly removed, and the parietes of the hollow are consequently found to consist of white healthy bone, not the slightest tenderness should exist, to indicate the exposure of any part of the internal cavity containing the membrane. The best period for the operation is, in fact, before decomposition has advanced sufficiently to have produced any cavity at all in the bone, and it is therefore only by cutting out the decayed spot, that a hole is formed for the reception of the stopping. The cavity to be filled

should be rather narrow in proportion to its depth, and, if practicable, should be made rather larger within than at its external orifice. The situation of the disease most favorable for the operation, is the grinding surface of the molares ; as the instruments are more readily applied, the cavity is more completely circumscribed, and its parietes more solid and complete than when it occurs in other parts of the teeth.

In those cases where the predisposing cause of gangrene is connected with a general diseased condition of the tooth, whether arising from original formation, or from any subsequent change, the prospect of a permanent cure can scarcely be entertained. The removal of one, and that the immediate and exciting cause of the progress of the disease, will indeed be effected ; but the predisposition will still exist in the apparently sound part of the tooth, and will be likely at a future period to give rise to the renewed appearance of decay. Hence it sometimes occurs, even when the gangrened part had been most completely removed, and the stopping effected in the best possible manner, that the disease will subsequently appear in another part of the tooth, while the stopping remains perfect and untouched. Without a proper understanding of the causes of gangrene, it would be impossible to explain this circumstance ; but with a knowledge of the physiology and pathology of these organs, the caution of the scientific and honorable practitioner, in not holding out the promise of certain success, where he knows the result must necessarily be more or less doubtful, will be well contrasted with the unhesitating boast of the empiric.

The complete removal of all the carious matter

is an essential requisite for the successful performance of this operation. The continued, and, in many cases, irremediable progress of dental gangrene has already been sufficiently proved to be produced by the irritation excited by the contact of successive layers of dead and decomposing bone, in the contiguous living, and previously healthy part of the tooth. It will therefore be obvious, that the removal of every particle of dead matter should precede the filling of the tooth, so as to leave no irritating body in contact with the sound healthy bone. This is in fact equally necessary, whether the excision be required simply for the removal of the disease as already directed, or as a preliminary step towards filling the tooth. In order to effect this, a number of little instruments are required, varying in their form and dimensions, according to the extent, form, and situation of the decayed portion.

The perforators, which are used for the purpose of enlarging the opening in cases where the decay is not yet sufficiently advanced to admit the cutting instruments, are similar, in form and application, to the common jeweller's brooch. The shaft is pentagonal, and the extremity ground to three sides, meeting at the point. It is fastened into a convenient handle, and its whole length is about five inches, of which the handle occupies four. In using this instrument, the end of the handle rests in the palm of the hand, and the fore-finger is extended towards the shaft, to direct the rotation of the instrument.

The excavators are either straight, or bent at various angles near the point. The cutting extremities vary also in their diameter, to accommodate

them to the size of the opening; and they are slightly curved, to act as a sort of scoop. I have given figures of some of the most generally useful forms;* but it would be impossible and useless to describe all the instruments which are occasionally used for this purpose.

When the dead and decomposed bone has thus been carefully removed, the cavity should be wiped perfectly dry with a bit of lint or cotton, wound round a small probe, so that not the slightest dampness shall remain, and the tooth is then to be filled.

The substance best adapted for this purpose is pure gold, both on account of its ductility and the toughness of its texture, and, more particularly, because it is not liable to become oxydized. Tin and silver are frequently used, but they combine too readily with oxygen to be sufficiently durable. Lead is still more objectionable, as its salts are readily soluble in the saliva; and where many teeth have been filled with it, particularly if the decay is extensive, and there is consequently a considerable surface of the metal exposed to the action of that solvent, the stomach may probably become materially disordered by it. Platina is free from these objections, but, in addition to its being usually alloyed to render it malleable, it is less tough and ductile than gold. Metallic compounds, fusible at a very slight degree of heat, have been recommended, and are now used, not only on the continent, but in some instances in this country. These are decidedly objectionable, not only for the reasons already given for rejecting other oxydizable metals, but also from the very imperfect manner in

* Plate X. fig. 1—4.

which the metal runs into the inequalities of the cavity, and the inadequate protection which it consequently affords.

The gold should be beaten very thin for small cavities, and rather thicker for larger ones, but in no case should it be so thick as not to be easily pressed into any form, and forced into all the irregularities of the cavity. It should also be thoroughly annealed after it is beaten to the proper thickness, in order to deprive it of the elasticity which it has received from the hammer.

A sufficient quantity of gold is to be taken in one piece to complete the stopping of each tooth ; for if too small a piece be used at first, and the deficiency be supplied by the second, the latter will be liable to be removed by the food in mastication. The gold is to be forced by degrees into the tooth, taking care that the first portion is placed in contact with the bottom of the cavity, and that every succeeding portion is firmly pressed against that which preceded it, so that every irregularity of the excavation shall be filled. If this be not attended to, and the whole of the gold be carelessly and slightly pressed into the cavity, and the degree of force necessary to its complete consolidation be afterwards given to the whole mass at once, it will often happen that the gold forms a hard solid body at the orifice, and a short space within it ; whilst the bottom of the cavity is left wholly unprotected. The gold is therefore to be gradually and firmly introduced into the cavity, every portion receiving the degree of force necessary to its consolidation, until the tooth is completely filled, and the gold forms a hard, unyielding, and continuous mass.

Any superfluous metal is then to be cut off, and the surface polished with a little steel burnisher.

The instruments for stopping, like those for excising the decay, vary in size and form. The points are either straight or curved, in a greater or a less degree, according to the situation of the cavity to be stopped, and the direction in which the force is to be applied. Those which I have figured,* are of a medium length and diameter. The handle should be large and full, so as to rest firmly in the palm of the hand, and a small flat button placed on the upper part of the shaft, at a short distance from the point, to receive the top of the fore-finger, will be found very useful in giving greater power to the hand, and thus very much increasing the degree of pressure. The length of the instrument should be about five inches and a half from the extremity of the handle to the button; the remainder of the instruments may vary in length, from three quarters of an inch to an inch and a half, including the curve, according to the part of the mouth to which they are to be applied. As a general rule, straight, or very slightly curved instruments are used for the upper teeth, whilst the lower require them to be bent at right angles.

It is not to be inferred that the instruments which I have now mentioned are the only ones ever required for filling the teeth; others may be occasionally necessary for particular cases, but it is to be recollected that the excellence of a surgeon is not usually esteemed to be in exact proportion to the multitude of instruments which he requires for his operations, but that on the contrary, the best

* Plate X. fig. 5, 6, 7, 8.

surgeon will in general attain his end by the fewest and least complicated means. It is not with any invidious feeling or object that I here advert to the employment of no less than "one hundred and seventy" instruments in stopping the teeth, accompanied, as this astounding declaration is, by the assurance that even this collection will not, in some cases, furnish the requisite form : but I think it necessary to remove from the mind of the young practitioner, some of the alarm and despair which I imagine must naturally seize him on contemplating the mysterious and interminable extent of his requirements, when entering upon the practice of his profession. I do not hesitate to say, that to a person of only common manual dexterity, and a little mechanical contrivance, the instruments I have described will be found sufficient for all common cases, and certainly all that the general practitioner in the country will ever be likely to require ; whilst, to the professed dentist, it will never be difficult to modify or construct, extempore, such additional instruments as are called for in anomalous cases.

When the bone has become softened by decay, to such an extent as to occasion pain on its being pressed, the total removal of the decay would of course expose the membrane, and render it impossible to fill the tooth without producing the most severe pain, and consequent inflammation. Notwithstanding this obvious effect, it is extremely common for persons to fill teeth in this state, either without removing the decayed part—in which case the dead and softened bone is forced into contact with the membrane—or, on the other hand, if the decay has been excised, and

the gold itself is pressed upon the naked nerve. In both cases the effect is the same. The membrane in some instances, becomes extremely inflamed, this is communicated to the periosteum and socket, and at length suppuration takes place after long continued and most severe suffering. In other cases, when the membrane is exposed only to a very small extent, symptoms are occasionally produced which can scarcely be distinguished from *tic douloureux*. If the cause of these attacks be understood in time, they may sometimes be relieved by the removal of the stopping, and by the application of leeches to the gum, and of some soothing remedy to the exposed and irritated nerve. That which I have found most efficacious, is a solution of nitrate of silver, introduced with a camel's hair pencil, or on a small bit of lint; the cavity having been previously cleaned and dried.

In those cases, however, in which the inflammation continues until the periosteum has become thickened, and matter has begun to be formed, the extraction of the tooth is generally the only remedy to be depended upon.

I was some time since sent for to visit a lady, then under the care of two medical gentlemen of eminence, who was suffering most severely from this cause. About a fortnight before I saw her, the *dens sapientiæ* of the lower jaw on the left side, had been improperly filled with gold, notwithstanding the pressure was found to give severe pain, which she was assured by the operator would speedily subside. It increased, however, during the night to the most excruciating degree; but

still an anxiety to preserve the tooth, and a reliance upon the assurance which had been given, that the pain would not continue long, induced the patient to refrain from having it extracted. On the second night the face became considerable swollen, and the elevators of the jaw were so contracted, that it was impossible to open the mouth, even to the smallest extent. Fever soon after came on, which continued up to the time when I saw her, accompanied still with severe pain and continued swelling of the face, and contraction of the muscles. Bleeding, both local and constitutional, had been employed by the medical attendants, who, concluding, from the mouth being so forcibly closed, that nothing could be done towards effecting the extraction of the tooth, had directed their attention exclusively to the reduction of the inflammation and fever. At length, however, the constitution became so much reduced by the continuance of fever, the loss of blood, and the difficulty of taking nourishment, occasioned by the total immobility of the jaw, as to excite the most serious apprehensions for the result. In this state was the patient when I saw her. The cheeks were flushed, the lips parched, the skin burning, and the weakness at the same time so great, that she could scarcely speak, or make the least exertion. Leeches were again applied to the angle of the jaw, and the face was constantly fomented, whilst at the same time I began to attempt some mechanical means for moving the jaw. With some difficulty I succeeded in introducing a thin piece of wood between the front teeth; and having once effected the slightest separation of the jaws, I proceeded to insert a wedge of wood be-

tween the teeth, which was occasionally introduced with sufficient force to obtain some increase of space by every renewed application of it, until I was enabled in the course of time, to introduce a small pair of forceps, and extract the tooth. From this time, notwithstanding the exhaustion consequent upon the operation, and the preliminary preparations for it, the irritation and fever subsided, and the health was speedily restored.

On removing the gold from the tooth, the cause of all the mischief became sufficiently obvious. The bone of the tooth had been softened by gangrene quite to the centre, and as it was not removed previous to the insertion of the metal, it was pressed against the membrane, and thus became the cause of the irritation which produced such frightful effects.

The following case occurred in the person of a medical gentleman of high and deserved reputation, and was related to me by himself.

This gentleman had several decayed teeth filled with gold by an eminent dentist. After a short time, an acute pain took place in all the facial branches of the fifth pair of nerves, which, from its peculiar character, and its not being referrible to any particular tooth, was attributed to *tic douloureux*. The remedies usually employed in that disease, were had recourse to, but without the least benefit. As the pain continued to increase, he again consulted the dentist who had filled the teeth, and who, on examining them, recollected that pain had been produced in one of them on

introducing the gold. It appeared probable that this substance was still pressing upon the nerve, and thus occasioning the sympathetic affection of all the nerves of that part of the face ; the tooth was therefore extracted, and the pain ceased from that moment, and never returned.

It would be easy to multiply instances in illustration of the bad effects of the mal-practice I have mentioned, but these will be sufficient to point out the impropriety of filling a tooth when the membrane is in the slightest degree exposed.

As a general rule, and one to which I would allow of no exceptions, a tooth should never be filled at a time when the pressure of the gold would occasion that peculiar pain which arises from contact with the membrane. It does not, however, necessarily follow that because the interior of the tooth is tender, or even the membrane exposed in a slight degree, that therefore no hope is to be entertained of filling it at a future time : if the cavity be of a size and form favorable for the operation, and the portion of the membrane which is exposed, be but trifling, it often happens, that measures may be successfully adopted, either to occasion the gradual absorption of that part, or, at least, such a diminution of its sensibility, as to allow of its being filled.

The absolute destruction of the nerve of the tooth has been attempted by a variety of means ; but the impossibility of instantaneously effecting this in such teeth as are situated at the back of the mouth, and possess several diverging roots, is a sufficient ground for rejecting this practice. The

actual cautery has been often recommended, and was at one time frequently employed for this purpose; and were it possible to apply it at a sufficiently high temperature, and without the danger of burning the mouth, it might perhaps be admissible in many cases. That this, however, is seldom, if ever practicable, is evident from the following considerations. The application of this remedy, where it is used for the purpose of the actual destruction of a part, can only be successful when applied at a white heat; for, if it be less intense, the destruction of the surface to which it is applied, cannot be effected so instantaneously as not to occasion inflammation. From this circumstance, I believe, arises much of that dread of the cautery which has occasioned the comparative rejection of its use in this country. It is not sufficiently recollected that there are two distinct objects for which its application is required; the one, the instantaneous destruction of a diseased structure—the other, the excitement of a counter-irritation. These two objects are to be attained by using the cauterizing instrument, heated to very different degrees of temperature. In the first case, as before observed, it is to be applied at a white heat, that the destruction of the part may be instantaneous, and that there may be no necessity for its remaining in contact with it for more than a single instant; in which case neither pain nor inflammation is produced in any important degree. In the other a less degree of heat is required, as the object is to produce the highest possible excitement, by suffering the cautery to remain for a longer time applied. As it is obviously impossible to apply it to the

nerve of the tooth in the former state, (because from the small size of the instrument, and the time necessary to direct it safely and accurately to the part, it must have lost a considerable degree of heat before it can be placed in contact with the nerve,) it must be given up in these cases as dangerous and inapplicable.

Sulphuric acid and other corrosive caustics are equally to be deprecated. The first and speedy effect of their application is, to produce extreme inflammation in the membrane, with such intense suffering as often to demand the immediate removal of the tooth ; or, if the patient has the courage to support this pain, in the hope of still preserving the tooth, the successive attacks of inflammation, excited by the repeated application of the caustic, will extend to the neighboring parts, and occasion thickening of the periosteum, and ultimately abscess in the socket, succeeded frequently by caries of the alveolar processes.

I return, however, to the more safe and practicable treatment, by which, under favorable circumstances, the sensibility of the membrane may be removed, or its absorption produced, so as to render it capable of receiving the stopping without pain or any subsequent inconvenience. There are several applications which are occasionally used for this purpose. One of the most common of these is opium, which is applied under various forms, but with very uncertain success. The cements, which have been so much used for this purpose, both on the continent and in this country, generally depend, for any degree of utility they may possess, upon the opium which enters into

their composition. It appears to me, judging from my own observation, that the continual application of a moderate stimulus, such as *alcohol*, *spiritus comphoræ*, a solution of nitrate of silver, &c., will be found a much more safe, as well as efficacious mode of treatment, than any attempt at destroying the membrane; whilst, on the other hand, it is much more speedy and certain than opium or other narcotics. It is not perhaps easily determined, nor is it of much importance in what way these applications produce the effect; whether by occasioning the actual absorption of that part of the membrane to which they are applied, or by gradually wearing out, as it were, its sensibility; it is sufficient that experience proves them to be efficacious. I have generally preferred camphorated spirit, or alcohol; as the nitrate of silver requires more caution in its management, and could not, perhaps, with safety be left to the patient's own care. The liquid should be applied at least three or four times in the day, on a small bit of lint or cotton, the cavity being previously rendered perfectly dry, and its use should be continued until considerable pressure no longer occasions pain.

OF TOOTH-ACHE.

The pain produced by the exposure of the membrane of a tooth to the action of external irritants, is certainly one of the most excruciating to which the human system is liable. The sensation is perfectly *sui generis*, and it is, unfortunately, as unnecessary as it would be difficult, to describe it; for

few persons who have arrived at adult age are so happy as to have escaped its attacks. Scarcely *tic doloureux* itself is more agonizing for the moment, than a darting paroxysm of tooth-ache. It is not, therefore, to be wondered at, that every new nostrum by which quackery professes to cure it, should, for a time, be eagerly caught at, especially as, in general, the only alternative is the removal of the tooth.

The sympathetic affections to which it gives rise, are exceedingly various and important; though it is only of late years that they have been properly understood, and the attention of medical men directed to their true source. Now, however, that these remote sympathies have excited a degree of interest more commensurate with their importance, so frequently are they found to occur, that practitioners are, on the other hand, in danger of attributing to this cause diseases which have not the remotest connexion with it. It not unfrequently happens that parts the most remote become the apparent seat of pain, from the exposure of the nerve of a tooth. I have seen this occur not only in the face, over the scalp, in the ear, or underneath the lower jaw, but down the neck, over the shoulder, and along the whole length of the arm.

It will be readily understood, by referring to what has before been explained of the connexions between the nerve supplying the teeth, and the other branches of the fifth pair which are distributed to different parts of the face, that irritation in different teeth will be attended by the occurrence of pain, referred to corresponding situations more or less remote from its true seat. No one of

these is so constant and so distinctly marked as the violent pain in the ear produced by the exposed nerve of the inferior *dens sapientiæ*. This is so general an occurrence as to constitute in many cases the only criterion of the true seat of pain, where several contiguous teeth are decayed. Cases of true ear-ache are comparatively rare; and I am convinced that where no actual *disease* of that organ exists, the pain referred to it will be found, very generally, to arise from a decayed inferior *dens sapientiæ*; and hence it often happens that blisters behind the ear, and hot applications to that part, produce only a partial and deceptive relief, the pain returning with increased severity as soon as the mind ceases to be amused by these ineffectual attempts at removing it; until at length a sudden paroxysm directs the attention of the patient to the true cause of the pain, and the extraction of the offending tooth effects an immediate and permanent cure.

When it is recollected that tooth-ache is the result of inflammation in one of the most sensible and highly organized structures in the body, it will not appear surprising that the application of remedies immediately in contact with the surface of this membrane, especially such irritating compounds as are generally recommended, should in most cases exacerbate rather than sooth the irritation. Even the best of them can only be considered as palliative, and, in by far the majority of cases, scarcely deserve this faint praise. Amongst those, however, which I have at different times tried, the following are perhaps the most frequently useful.

℞ Aluminis ʒi.
Spir. Æther. Nitrici fʒ ss. Misce.

℞ Acid. Muriat. fʒ ss.
Aquæ distillatæ fʒ ij. Misce.

℞ Argenti Nitrat. gr. i.
Aquæ distillatæ fʒ i. Misce.

A small bit of lint, wetted with either of these liquids, may be frequently introduced into the cavity, which should be carefully dried previous to each application.

It is, however, only by treating this affection, as nearly as the circumstances will admit, upon the same principles as inflammation in other parts, that any relief can, in general, be rationally expected. In those attacks, therefore, in which the inflammation is considerable, and there is any particular reason for preserving the tooth, leeches should be freely and repeatedly applied to the gum, the bleeding being encouraged by repeatedly holding warm water in the mouth. After the inflammation and pain are thus reduced, should the nerve be only in a small part exposed, the means already mentioned for diminishing its sensibility may be had recourse to. But the hope of relief which these remedies may, from occasional success, hold out, is, in most instances, completely fallacious, and the extraction of the tooth can alone be depended upon.

It may, perhaps, be regarded as scarcely permissible to advert here to a practice which has lately been revived in this country with promises of success, which would put even empirical boldness to

the blush: but I will not be induced, by any false delicacy, to withhold from those whom I profess to instruct in what I believe to be rational and true principles of practice, the exposure of error wherever it assumes a tangible shape. Neither my feelings nor my objects can be either personal or interested—but I have seen too much of the injurious (would that I had not to add fatal) consequences which have resulted from the practice I am now deprecating, not to lift up a warning voice, feeble as it is, against it. I allude to the operation of excision, as it is called, or the cutting off of decayed teeth. It is an operation irrational in its principle, often useless in its immediate effects, and in its consequences most pernicious.

It has always appeared to me to place the operator in a dilemma of evils. The object, I presume, is to cut through, or, more properly, to break off the tooth so low as to remove the whole of the crown, including the cavity which contains the pulp or membrane. If this object be effected, the consequence is that the dead roots remain in the alveoli; and these, if not immediately productive of pain, may yet be expected to occasion much future suffering as extraneous irritating bodies. Every one knows what is the usual result of the existence of dead roots in the jaw, when they have been left either by accident in an attempt at extraction, or by the gradual decay of the crown; and it is surely too much to adopt as a useful operation, that which every one deprecates as an accidental occurrence.

If, on the other hand,—as indeed it frequently happens,—the object aimed at be not fulfilled, the

case is placed in a situation incomparably worse than before, the nerve being still more exposed, and the hope of the ready and easy extraction taken away by the loss of that part of the tooth which would have afforded a solid support for the instrument.

I could say much more, and illustrate and confirm these observations by cases of frightful interest, but I trust I have said enough to dissuade the rational and well-educated practitioner from adopting so injurious an operation.

OF
GANGRENE IN THE TEMPORARY
TEETH.

THE temporary teeth are scarcely less liable to the disease just treated of than the permanent ; but there are some peculiarities attending its occurrence in the former, which are worthy of notice, as leading to the adoption of a rather different mode of treatment. As these teeth are intended to serve but a temporary purpose, and to masticate those softer substances only which constitute the proper food of childhood, they are not only of a less robust form, but their substance also is less solid and durable, and the pulpy membrane of the cavity, which serves as the medium through which their nerves and vessels pass, requires, therefore, to be less firmly and perfectly organized. This will appear extremely probable when it is remembered that, as absorption proceeds in the gradual corrosion of their roots, for the purpose of throwing them off as the permanent teeth become perfected, the membrane must be necessarily exposed to frequent pressure, and, were it not less liberally supplied with nerves than the permanent one, would be subject to continual attacks of pain. Hence then it appears that, although from the comparative imperfections of structure to which I have alluded, these teeth are very liable to mor-

tification, and that from the same cause its progress in them is extremely rapid, yet when the interior becomes exposed by it, the tooth-ache arising from that exposure is of a much less severe character than in the permanent teeth, and frequently yields to the application of anti-irritants; whilst it may be also observed that the membrane either very soon becomes absorbed, or its structure is so changed as to cease for ever to be the seat of any considerable pain.

On the other hand, however, it is found that if the inflammation thus excited be not speedily subdued, the delicate and sensitive state of the parts immediately connected with the tooth at this period, occasions a high degree of inflammatory action, leading frequently to alveolar abscess and consequent exfoliation. Independent of the pain which the little patient must suffer from such a cause, and the constitutional excitement which is often set up in consequence of it, the permanent tooth beneath the affected temporary one, must necessarily suffer more or less injury from the extension of the inflammation to the pulp and membrane.

The treatment which is obviously indicated by these considerations will, as I have found by experience, very often enable us to retain the temporary teeth, until the time when they are spontaneously removed by absorption.

As soon as pain is produced in a temporary tooth, and, if possible before any extension of the inflammation has taken place to the surrounding parts, any of the liquids which have been already mentioned, as occasionally useful in tooth-ache, should be introduced; and the best of these,

perhaps, is the dilute muriatic or nitric acid. A leech should also be applied to the gum, and repeated as often as the recurrence of pain renders it necessary. Should inflammation have even extended to the gum and alveolus, still, if it has not yet produced suppuration, the free application of leeches will be very likely to relieve it; and as it often happens after one or two attacks of this kind, that absorption of the internal membrane takes place, the relief thus afforded is frequently permanent, and the tooth is preserved.

I have already shown that considerable importance ought to be attached to the preservation of the temporary teeth during the formation of the permanent ones; and I am led by this consideration, the more decidedly to deprecate their too early extraction, with whatever object it may be proposed. It will be remembered, that at the early periods of the formation of the permanent teeth, the connexion between their rudiments and the temporary teeth still exists, and that the structure of the former would be probably injured by the too early destruction of that connexion; in addition to which, the loss of the temporary teeth before the permanent ones are ready to fall into their proper situation in the maxillary arch, has been shown to lead to the probable contraction of its span, and the subsequent irregularity of the teeth. It will, however, be obvious, that, on both these grounds, the importance of retaining the temporary teeth diminishes, in proportion as they approach the period of their natural removal.

At the same time that these considerations should have their due weight in leading us to retain the temporary teeth in all cases where it can

be done with impunity, we must not, on the other hand, disregard the injury which the extension of severe inflammation to the permanent rudiments, may produce in the formation of these teeth. Should therefore the plan already suggested for the reduction of the inflammation have failed, and, especially, should suppuration have taken place, the immediate removal of the tooth is imperatively called for.

OF

TOTAL NECROSIS OF THE TEETH.

WHEN the vitality of the whole substance of a tooth has at once been destroyed, and its connexion with the system totally cut off, it presents none of the appearances which characterize the partial and gradual gangrene of the teeth which has been described. To this condition of a tooth the term *necrosis* has been applied; and although the discrimination between gangrene and necrosis would be inadmissible in other bones, I shall avoid the confusion which the alteration of the term would create in the present instance, and consider *dental necrosis* as indicating the death of the *whole* tooth, as *gangrene* has been applied to its gradual mortification and decomposition.

The causes of this state of a tooth are various. A blow sufficiently forcible to break the vessels which enter the foramen of the root, for the supply of the tooth—inflammation existing to so severe a degree as to occasion the separation of the internal membrane—fever—the immoderate use of mercury—and many other causes may produce it. The teeth which are the most subject to it are the incisores or cuspidati, though sometimes the other teeth are found similarly affected.

After a tooth has been for some time dead, it begins to assume a darkish appearance, which in-

creases gradually until it becomes almost black. This is more particularly the case where it has been occasioned by a blow, or any other sudden cause, by which the return of blood may have been prevented. In the mean time, inflammation takes place in the socket, the gum becomes swollen and spongy, and a constant discharge of matter takes place, either at the edge of the gum, or through one or more openings opposite the root. Absorption of the alveolar process, and the consequent loosening of the tooth, generally result from this affection. On the removal of a tooth under such circumstances, the root is found to be much blackened, irregular absorption has taken place on every part of it; and, generally, from the exposure of the root to the saliva, by the absorption of the alveolar process, it is covered with small scattered spots, of hard, dark-colored tartar.

The state to which the roots of teeth are reduced, after the total destruction of the crown and internal membrane by gangrene, is perfectly analogous to this condition of the teeth. They are extraneous bodies in the alveoli, neither possessing an internal nor external means of connexion with the system, and generally producing the same symptoms as those produced by necrosis. It has been already observed, that when gangrene has gradually proceeded to this extent, the vitality of the roots being wholly destroyed by the destruction of the membrane, no farther progress of that disease can possibly go on, and we find the roots remaining, in many cases, for years, without much alteration.

If this fact be properly considered, it affords a

most striking proof of the vitality of the teeth. As long as the membrane continues to supply the teeth with vessels and nerves, and to keep up its connexion with the system—in other words, as long as its vitality exists, the gradual extension of gangrene goes on, from the cause to which I have already attributed it : but as soon as its source of vitality is cut off by the destruction of the membrane, the progress of gangrene is arrested, and the root becomes exposed to that gradual destruction only, which is effected, on the one hand, by the action of the absorbents of the alveolar periosteum, in contact with it ; and, on the other, by the agency of heat and moisture externally. The method by which these dead and useless roots are at length thrown off, is curious. Not only does the exposed surface gradually decay by the saliva constantly acting upon it, and absorption at its extremity continually diminish its substance, but a deposition of bone takes place at the bottom of the alveolar cavity, whilst the alveolar process and gum are also absorbed, until at length the root is either loosened and comes out, or is found lying horizontally upon the gum in which it remains partially imbedded. In other cases, however, these dead roots become the cause of numerous morbid affections hereafter to be considered.

In the earlier stages of necrosis, free and repeated scarification of the gum, followed by the application of a strong astringent lotion, will be found very beneficial : I have also employed the injection of a solution of sulphate of zinc underneath the gum into the enlarged alveolus, by means of the extremely fine tube of a syringe, with much advantage in checking the formation of pus, and giving

tone to the gums. It is, however, obvious, that when an extraneous body, like this, exists in the socket, nothing short of its removal can effect a cure.

To an identical, or precisely similar, condition of the teeth, must be referred the results of those cases, in which attempts have been made to cure tooth-ache, and arrest the progress of the caries by the temporary removal of the tooth, and the subsequent replacement of it in the socket after having cut out the decayed part, and filled the cavity with gold. Mr. Fox, who, I believe, first proposed this plan, did so upon sufficiently plausible data, but found in all the cases in which he adopted it, that after a few weeks, (I should have expected that a few days would have been sufficient,) there came on inflammation of the periosteum of the alveolus, sponginess, swelling and tenderness of the gums, suppuration, and, in short, all the circumstances which I have already described as attendant upon necrosis; and which required the immediate and permanent removal of the tooth. The candor with which this conscientious writer acknowledges the failure of a mode of treatment, which, emanating from his own ingenuity, was evidently a favorite one, constitutes an example so praiseworthy, and evincing so much of integrity and simplicity of motive, that it is devoutly to be wished it were more generally followed. It is the opprobrium of medical literature, that, in most instances, writers who have occasion to illustrate their subject by reference to their own experience, record such cases only as have had a successful termination, keeping back

those, perhaps the most instructive, in which their favorite plans have failed. Conduct like this not only bespeaks the object and motive of publication to be disgraceful and self-interested, but leads often to the most erroneous conclusions, and to the most fatal and destructive results.

A few observations on the subject of transplanting teeth, may not be misplaced here.

It was Mr. Hunter who first proposed to remove a diseased front tooth, and instantly extracting from another person a corresponding sound one, transfer it to the socket from which the former had been removed. This ingenious idea took its rise from the success which had attended the experiments of this great physiologist in transferring a tooth from its socket, into an incision made for the purpose, in the comb of a cock, to which it became so firmly and intimately united, that, on killing the animal some time afterwards, and injecting its head, the injection ran freely into the vessels of the internal membrane of the tooth.

There appears, *prima facie*, to be some ground for apprehension, that infectious diseases may be communicated by this operation, and on this account it may with great propriety be deprecated, even were it in every other respect perfectly successful and unobjectionable, which, however, is far from being true. Many cases of severe, and not a few of even fatal results are on record, from a consideration of which I cannot avoid denouncing the operation as dangerous, and, in the present state of our information, the operator who performs it as either grossly ignorant or unprincipled. In

addition to the objection of possible infection, a tooth transferred from one socket to another cannot be expected to fit perfectly into its new situation; and from this inaptitude of the root of the tooth to the alveolar cavity as well as from the injury necessarily done to the periosteum by the extraction of the former, and the force requisite in replacing the new one, a living and healthy union is not to be anticipated: and we find, in fact, that a tooth thus circumstanced, speedily shows itself to be the subject of necrosis, and exhibits in the highest degree every symptom which I have described, as characterizing that affection.

The temporary teeth are also liable to total necrosis, but the effects which they produce are in some measure different from those which result from the death of the permanent teeth. It very commonly happens, that when the temporary roots remain as extraneous bodies in the sockets, that absorption takes place in the alveolar process and gum opposite to their extremities, by which they become gradually exposed. The points, by their pressure against the lip or cheek, occasion ulceration, which, in unhealthy constitutions, very often assumes a peculiar and almost malignant appearance. The ulcer is deep, surrounded by a thickened and somewhat everted edge, and is exceedingly painful and irritable. In those cases in which the incisores are the cause of this affection, the points of the roots alone are generally exposed; but where the molares are thus affected, it more frequently happens that the whole of the outer side of the tooth is denuded. The swelling of the lip or cheek, and the thickened edge of the

sore, occasion the extremities of the roots to be as it were imbedded in the ulcer. The constitutions in which the gums are most liable to these ulcerations, are those of weakly children, and especially those of scrofulous habit.

As long as the tooth remains in the socket, very little improvement is to be anticipated in the state of the ulcer.

The removal of the tooth itself does not always immediately destroy the irritability of the ulcer; its cure may then be accelerated by the frequent application of a weak solution of sulphate of zinc, or very dilute nitric acid, by means of a camel's-hair pencil; at the same time the administration of tonic medicines, where the constitution is debilitated, and if the state of the stomach will permit, will be found very useful.

OF

ABSCESS IN THE BONY STRUCTURE.

I HAVE already alluded, when treating of the vitality and organization of the teeth, to a case, the only one I believe on record, in which a formation of pus with corresponding absorption of part of the bone took place, in the very substance of the crown of the tooth. I have before endeavored to deduce from this remarkable fact the support which it affords to the doctrine in question, and shall now content myself with a detail of the case.

Mr. S——, a medical gentleman, had long been suffering extreme pain in the right side of the lower jaw, apparently produced by the second molar tooth, which, however, had no external marks of disease. After a time, inflammation took place in the periosteum of the root, and the tooth was in a measure loosened. As it now became evident that the cause of the pain, which still continued to the most excruciating degree, was produced by this tooth, it was extracted; and as no diseased appearance was found on its surface, I sawed it asunder at the crown, and found a cavity in the solid bony structure, perfectly circumscribed; the surrounding bone being white, and of a healthy and sound texture. Not the slightest appearance of disease existed

in any other part of the tooth, excepting, that, from the inflammation which had so long existed, the membrane had also begun to suppurate. In this case, then, it appears that inflammation had occurred from some local cause in the bone of the tooth; that the vessels of the bone had formed pus; and that absorption had taken place in consequence of its pressure, and formed a cavity for its reception.*

* Plate ix. fig. 4.

OF

EXOSTOSIS ON THE TEETH.

A DEPOSITE of bone occasionally takes place, on some part of the root of a tooth, which must be considered as perfectly identical with exostosis in other bones. Whether the bony matter in this case is produced by the vessels of the periosteum, or by those of the tooth itself, cannot perhaps be ascertained, though from analogy there is every reason to believe the former. The substance, which is thus added, differs in appearance from the original bone: it is of a particularly hard, dense texture, of a yellowish hue, and slightly transparent; and the irregular manner in which it is deposited gives it no inconsiderable superficial resemblance to chalcedony. It is undoubtedly occasioned by an increased and irregular action of the vessels—a kind of slow chronic inflammation; the result, in most cases, of incipient gangrene, or some similar cause of moderate but continued irritation. Hence its progress is so tardy, that, in most instances, the enlargement of the alveolus by absorption, almost keeps pace with the deposition of new bone; and the pressure which the latter produces is so trifling and gradual, as to occasion no more than a slight, though continued uneasiness; and it is only when the caries has extended to the cavity, and tooth-ache is produced by the exposure of the membrane, that the patient is induced to lose the tooth, and that the true cause of the previous affection is ascertained. In other instances the continued irritation occasions thicken-

ing of the periosteum, and afterwards suppuration, and the case becomes one of simple alveolar abscess.

The pressure arising from this enlargement of the root sometimes produces an affection exactly resembling *tic douloureux*. I have seen several cases of this description more or less distinctly characterized, in one of which the affection was of so marked a character, that the constitutional remedies usually adopted in *tic douloureux*, had been employed for a long time before it was suspected that the cause was local. The tooth was decayed, but the pain, though excessively severe, was so different from tooth-ache, that the medical attendant did not suspect the cause to be in any way connected with the tooth. On examining it, however, I found that although the nerve was not exposed, yet, on striking it smartly with a steel instrument, a sharp pain shot suddenly through the jaw, exactly resembling the former attacks; and it is worthy of remark, that this effect was only produced when it was struck in one direction. On the removal of the tooth, the root was found considerably enlarged by exostosis.

My own experience, as far as it goes, would have led me to believe that this disease is never spontaneous, as I have not myself seen it occur in a tooth which was in other respects healthy. Mr. Fox, it is true, details a very interesting and well marked case, in which, as he says, two apparently sound teeth were the subjects of exostosis, and in which severe pain and considerable constitutional excitement had for a long time existed, which were perfectly relieved by the extraction of the teeth, the roots of which were found greatly enlarged by this

bony deposite. It will however appear to any one who consults Mr. Fox's work, that the figures given there of these two teeth, convey the impression of their being somewhat decayed ; and I have it in my power to set the question at rest as far as regards the present case, as the identical teeth are now in the collection at Guy's Hospital, and though certainly not decayed to the extent which the figures in Mr. Fox's work would lead one to believe, are both the subjects of *incipient* gangrene, which, however, is so slight, as to have been probably unnoticed in his examination of the mouth previous to their removal.

The following case is important, as it shows from how small an exostosis of the root of a tooth, the most marked and painful symptoms may arise.

Mr. — had for some months suffered severe and frequent paroxysms of pain on the left side of the face, apparently commencing in the second inferior bicuspid, and darting through the lower jaw to the ear, and upwards to the temple. The pain resembled *tic douloureux* in the nature of its attacks, but was evidently produced by a local rather than a constitutional cause, from the paroxysms occurring without the least periodical regularity, and from their being excited by the application of heat to the teeth of that part. On the most careful examination, however, I could not discover the least appearance of caries in any of the teeth, and I therefore ordered leeches to be applied to the gum, and directed aperient medicines and abstinence from all stimulating food. This plan was productive only of temporary and partial relief, and in

about two days the pain was as severe as ever. Finding that a smart blow on the second bicuspid produced a more painful sensation than on any other tooth, I determined on extracting it, and found the extremity enlarged by a deposition of bone, giving to it a slightly bulbous shape, but not larger than the tip of a small quill. The newly added bone was yellower and more transparent than the original structure, as is generally the case in this disease. The removal of the tooth was followed by immediate and entire relief.

As the consideration of the numerous painful nervous affections which derive their origin from the teeth, and of others which may be confounded with them, will occupy another portion of this work, it is unnecessary at present to enter more fully into that subject. The cases already on record, and those with which I shall have occasion to illustrate my views of the nature of the affections in question, will abundantly prove to how great a degree they depend upon such local causes as I have mentioned, and how important it always is to ascertain most carefully the state of every tooth, even where external signs of disease are wholly wanting. Whether the cause be the irritation of an exposed nerve, from gangrene, or from accidental fracture—the pressure of exostosis, or the irritation of extraneous bodies in the socket—the effects are so identical, and at the same time so liable to be confounded with affections of the nerves, from remote and even constitutional causes, that their discrimination becomes a subject of no less difficulty than interest.

OF

INJURIES TO THE TEETH, PRODUCED BY MECHANICAL VIOLENCE.

THE infliction of mechanical violence on the teeth is so frequent an occurrence, and the injuries which are thus produced differ so widely in their nature, as well as in extent, that it is as difficult as it is important to lay down any general rules, sufficiently comprehensive to embrace all the cases which occur, even in the common routine of practice. From the mere splintering of a small portion of enamel, to the comminution of the root in the socket—and from the slightest loosening of a tooth, to its actual dislocation from the alveolus, or being driven into the very substance of the jaw bone—so many different degrees of injury are included, that it is almost impossible to indicate at what point one mode of treatment shall be required, and where another ceases to be efficacious. In addition to this difficulty, the results of the same apparent degree of violence differ so much, in consequence of variety of constitution and other causes, as frequently to falsify the most reasonable and well grounded prognosis.

The loss of a portion of the enamel by a blow is, in many cases, productive of no ill consequences. If the whole thickness of the enamel be not broken off, nothing farther is necessary than to file the part smooth; and, as the bone is, in this case, still protected by a layer of enamel, the tooth

is not liable to farther injury, unless the violence has been sufficiently severe to produce inflammation of the socket, or loosening of the tooth. Should a piece of the enamel, including its whole thickness, be broken, the portion of bone which is thus exposed, is rendered liable to be acted upon hereafter by the usual external causes of gangrene ; though it frequently continues with no other alteration than a slight degree of discoloration for many years.

The loss of a portion of the bone, from similar causes, will give rise to various results, according to the degree of injury which the tooth has sustained. If a small portion only be broken, so that the internal cavity is not exposed, a slight degree of tenderness is produced in the bony structure, and a susceptibility of pain on the application of an instrument, or of cold or hot fluids. The consequences in such a case are, in general, either the immediate occurrence of inflammation, by which thickening of the periosteum, slight loosening of the tooth, sponginess of the gums, and sometimes even alveolar abscess, are produced—or the remote appearance of gangrene in the exposed portion of the bone. In many cases, however, a slight fracture of this description is not followed by any injurious consequences for a very long period, and probably even through life ; and a deposit of bone is, under these circumstances, often found to have taken place in the cavity, commencing opposite to that part of the tooth from whence the broken portion had been lost.

A more extensive fracture, by which the actual exposure of the membrane is occasioned, is often followed by more serious effects. Inflammation will,

of course, in such a case, immediately supervene, and seldom fails to produce a very diseased state of the gums and alveoli, unless the fractured tooth be immediately removed. If the tooth be suffered to remain, it sometimes happens that the inflammation causes the actual death of the tooth, after the formation of pus in the alveolus, and, possibly, in the cavity of the tooth also; the result of which is, the putrefaction of the membrane, and the formation of a passage from the alveolus through the tooth, by which matter continues for a long time to be discharged.

In the case of the simple loosening of a tooth, without fracture or actual dislocation, the degree of probability which may exist of its being ultimately reinstated in its former firm and sound condition, depends upon the kind and degree of violence which was applied to it, and the state of the constitution at that time; but, in the majority of cases; even where the force has not been sufficient to alter the situation of the tooth, and where the constitution is sound and healthy, a blow sufficiently hard to render a tooth loose will be ultimately found to have destroyed its attachment to the socket, or rather to have cut off its immediate connexion with the system, by the rupture of its nerve and vessels at the extremity of the root. In a few rare instances, it is true, teeth have again become firm and have never afterwards exhibited any signs of the destruction of their living principle; but, in the greater number of such accidents, notwithstanding the teeth may become temporarily firm, they at length assume a darker hue than is natural, which gradually increases until it

becomes nearly black, unless it should, in an early stage, produce irritation, and therefore require extraction. The invariable result, sooner or later, is, that teeth in this condition, being deprived of vitality, or, in other words, being in a state of *total necrosis*, produce inflammation in the periosteum of the socket, the formation of alveolar abscess, and, in many cases, subsequent caries of the alveolar processes.

In more violent accidents, the symptoms are of course more immediate, and proportionally severe. A tooth partially dislocated by a sudden blow, rarely, if ever, becomes thoroughly firm, after being forcibly replaced. In the most favorable cases, a certain degree of mobility remains, and, as a quantity of lymph is poured out in consequence of inflammation in the socket, which becomes organized, the tooth is again forced more or less out of its place. The thickened alveolar periosteum is rendered exceedingly tender, so that the slightest pressure on the tooth gives great pain, and these symptoms increase till the formation of alveolar abscess, as in the former case, calls for the removal of the tooth. I have, however, known a tooth remain tolerably firm, after partial dislocation, for months, and even for a year or two, without any other inconvenience than extreme tenderness in the socket, and, consequently, the necessity of constant care, to prevent any accidental violence being applied to it. The cases are so rare, in which any degree of comfort will succeed the replacement of a tooth which has been in any degree dislodged from its attachment to the alveolus, that no decided prospect of a cure ought ever to be held

out to the patient; but on the contrary, if the wishes of the patient, the importance of the tooth in articulation, or any other circumstance should render an attempt at its preservation particularly desirable, it should be accompanied with the assurance, that the chances of ultimate success are small. In replacing the tooth thus partially dislocated, it should be pressed with great firmness and steadiness into the socket, until it is restored exactly to its former situation, or as nearly so as possible; and it may be retained there, by means of a ligature of soft but strong silk passed round it, and fastened to a firm tooth or two on each side. The ligature in this case should remain on until the inflammation has subsided, which may be accelerated by the repeated application of a leech to the gum; and I should in this, as in all cases where the gum is irritable or inflamed, prefer soft silk, to the hard twist which is usually employed.

The following case will serve as an illustration of the foregoing observations, as it affords a fair specimen of the usual symptoms which attend such an accident, and of the degree of success which may be generally anticipated from the replacement of a tooth so circumstanced.

Miss J. E., in running rapidly down stairs, slipped, and in falling her mouth struck the banister, by which the right central incisor was partially dislocated. I saw her about an hour after the accident, and found the tooth forced nearly a quarter of an inch below the level of the others, and much loosened. By this time a solid coagulum had formed in the socket, filling up the space left void by the partial dis-

placement of the tooth. With some force, however, and not without producing great pain, I succeeded in replacing it with tolerable accuracy; a thin soft ligature was attached to it, and to the neighboring teeth, and leeches were ordered to be repeatedly applied to the gum, until the inflammation had subsided: as soon as this was the case, a strong astringent lotion was ordered to be used several times in the day. At the present time, twelve months after the accident, the tooth is perfectly firm, but it is still a very little lower than the others, and projects in a slight degree; though, in both these respects, it appears to be gradually improving, by the gradual absorption, doubtless, of the organized lymph, which had formed at the bottom of the socket. It is still too tender to be of much use in mastication, and the gum is still liable to occasional attacks of slight inflammation.

In cases of total dislocation, where the tooth has been forcibly struck out of the socket, there is generally so much injury inflicted upon the alveolar processes, that still less hope exists of its being replaced with any advantage. There is one favorable circumstance, however, which belongs to such a case, and that is, the opportunity which it affords of clearing the socket from any coagula which may have formed there. For this purpose, warm water should be thrown into it by means of a syringe, and after all the blood is thus removed, which may be assisted, if necessary, by a pair of small dressing forceps, it should be farther cleaned by a small bit of lint, rolled round the

end of a probe. The tooth, having been placed for a moment in warm water, about the temperature of the body, is to be restored to its exact situation, and supported, as before directed, by a ligature embracing one or two teeth on each side of it. By this plan, if the alveolar process and its periosteum have sustained no injury from the blow, the tooth may, in some cases, be retained for a considerable time, without any annoyance, after the first effects of the accident have subsided. Should pain and inflammation supervene, leeches must be applied to the gums, and the usual plan for the general reduction of inflammation be strictly followed. In all these cases, however, favorable as the circumstances may be, there is always great reason to apprehend that the death of the tooth will at length be found to have taken place, from the occurrence of the usual consequences of their existing as extraneous bodies in the socket, on which I have so repeatedly dwelt.

The following case of severe and complicated injury, combining both fracture and luxation, is somewhat interesting, as it shows to what an extent violence may be offered to the alveolar processes and neighboring portions of the maxillary bone, without producing any subsequent exfoliation or other mischief.

Mr. P., a young gentleman about twenty years of age, took a leap, when hunting, over a hedge, on the other side of which was a ditch, which the horse failed to clear, and fell with great violence. As the horse plunged in rising, Mr. P. received a violent blow on the mouth

from the fore-hoof, which, as he supposed, struck out the four front teeth of the upper jaw. The mouth became excessively swollen, and matter formed, though in no large quantity. He immediately came to town, and consulted me on the injury, and I found, on examination, that the fractured remains of two of the teeth—a central and a lateral incisor—still remained in the alveoli, the root of each being broken in several pieces, which, with some difficulty, I removed. The other lateral incisor had been dislocated without fracture; but on examining the alveolus of the other central incisor, I felt what I believed to be the root, driven some way into the bone; and on extracting this body by means of a small pair of dressing forceps, I found that it was the whole of the central tooth unbroken, which had been forced upwards and backwards, into the very substance of the bone. A small portion of the alveolar process, which had been broken by the blow, was taken away, after which the gum healed without farther trouble.

OF THE

LOSS OF THE ENAMEL, AND WEARING
DOWN OF THE TEETH.

MR. HUNTER appears to have been the first writer who described the remarkable, and hitherto unexplained affection, termed by him "*decay of the teeth by denudation.*" It consists of a gradual loss of substance, generally without the slightest discoloration or any diseased appearance. In all the cases in which I have been able to observe its commencement, it appears to have begun on the surface of the enamel; in most it attacks first the central incisores, sometimes removing the anterior surface of the enamel, either generally or in irregular patches—in other cases making a perfect and regular horizontal groove, which very gradually increases until it has extended through the enamel to the bone. From the central it passes on to the lateral incisores, and from them in succession to the cuspidati, the bicuspidates, and even, in some cases, to the molares. The groove is perfectly straight and continuous through its whole extent, and is often as regular and smooth as if it had been formed by a fine round file, and afterwards polished. When the bone of the tooth is exposed by this process, it sometimes becomes very slightly discolored; but remains for a long time perfectly hard and sound, and seldom exhibits any appearance of gangrene. I have, in some instances,

known it to extend so deeply as nearly to expose the nerve, and in others, though very rarely, it lays the foundation of gangrene, in the same manner as filing occasionally produces the same disease; namely, by exposing the bony structure to various external causes of inflammation. Indeed this exposure is generally accompanied by a greater or less degree of tenderness, and a susceptibility of pain from the application of acids, or from sudden changes of temperature.

The cause of this affection has hitherto remained unexplained. Mr. Hunter says, "from its attacking certain teeth rather than others, in the same head, and a particular part of the tooth, I suspect it to be an original disease in the tooth itself, and not to depend on accident, way of life, constitution, or any particular management of the teeth." This opinion, which, for reasons I shall presently state, I believe to be erroneous, appears to have been founded upon another affection of the teeth, which, though similar in its general appearance, doubtless arises from a very different cause, but has been confounded by Mr. Hunter with that now under consideration. "I have seen instances," says this author, "where it appeared as if the outer surface of the bony part, which is in contact with the inner surface of the enamel, had first been lost, so that the attraction of cohesion between the two had been destroyed; and, as if the enamel had been separated for want of support; for it is terminated all at once."

In this passage Mr. Hunter describes very accurately the result of superficial absorption of the bony structure; a circumstance which I have occasionally seen, though more rarely than the

present abrasion of the enamel, with which it cannot, for a moment, be considered as identical. In one case, the enamel is gradually and slowly removed by a regular and uniform excavation; in the other, the abruptness and irregularity of the edges show that it had broken away at once, from having lost its subjacent support. The cause in the former is external, in the latter it is within the enamel.

Mr. Fox conjectured, that it might be produced by some solvent quality in the saliva, a supposition wholly at variance with the fact, that certain teeth are more liable to it than others, as well as with the situation of its commencement, and the regularity of the direction in which its ravages are carried on.

The invariable situation of its commencement on the surface of the enamel, forbids, from the known structure of that substance, the belief that it is produced by absorption. The most obvious solution of the question would be, that it was the result of friction; and I have seen so many instances in which it has appeared to be produced, or at least increased, by the use of rough or acidulated tooth powders, that I should not hesitate to assign to it such a cause, were it not for certain cases which have exhibited this affection to a considerable extent, without any applications of that kind having ever been used; and others in which, although friction of every kind had been ordered to be discontinued, in consequence of this denudation having commenced, yet the enamel still continued to be removed.

Whatever may be the cause, and at present I confess myself at a loss to explain it, the horizon-

tal direction in which it proceeds, may, I think, be connected with the manner in which the enamel is deposited during its formation; for it will be recollected that it first covers the apex of the tooth, and gradually invests the crown *by successive circular depositions*; it is, therefore, not improbable, that from some temporary cause, acting during its deposition, certain circular portions may be more liable to mechanical abrasion or other injury than the rest.

A very remarkable instance of an affection, analogous at least to that which I have just described, has lately occurred to my notice, in the case of a gentleman, about twenty-five years of age, whose anterior teeth, both of the upper and lower jaw, have suffered a very considerable loss of substance, both of the enamel and bone. In this case it commenced at the edges of the incisores, and has now extended far into the bodies of the affected teeth.

The following is the detail of this curious case.*

About fourteen months since, this gentleman perceived that the edges of the central incisores, both above and below, had become slightly worn down, and, as it were, truncated, so that they could no longer be placed in contact with each other. This continued to increase, and extended to the lateral incisores, and afterwards successively to the cuspidati and bicuspidates. There has been no pain, and only a trifling degree of uneasiness on taking acids, or any very hot or cold fluids into the mouth. When I first saw these teeth, they had exactly

* Plate IX. fig. 10.

the appearance of having been most accurately filed down at the edges, and then perfectly and beautifully polished ; and it has now extended so far, that when the mouth is closed, the anterior edges of the incisores of the upper and lower jaws are nearly a quarter of an inch asunder. The cavities of those of the upper jaw must have been exposed, but for a very curious and beautiful provision, by which they have become gradually filled by a deposit of new bony matter, perfectly solid and hard, but so transparent, that nothing but examination by actual contact could convince an observer that they were closed. This appearance is exceedingly remarkable, and exactly resembles the transparent layers which are seen in agatose pebbles, surrounded by a more opaque mass. The surface is uniform, even, and highly polished, and continuous without the least break, from one tooth to another. It extends at present to the bicuspidates, is perfectly equal on both sides, and, when the molares are closed, the opening occasioned by this loss of substance in front, is observed to be widest in the centre, diminishing gradually and equally on both sides, to the last bicuspidates.

On the cause of this very extraordinary occurrence I confess myself wholly at a loss to offer even a conjecture. It cannot have been produced by the friction of mastication, for these teeth have never been in contact since the first commencement of the affection ; nor does it arise from any apparent mechanical cause, for nothing is employed to clean the teeth, excepting a soft brush. Absorption will equally fail

to account for it; for not only would this cause operate, as it always does, irregularly, but we find that instead of these teeth being the subjects of absorption, a new deposition of bony matter is, in fact, going on, to fill the cavities which would otherwise be exposed.

As I have here alluded to the mode which nature adopts to prevent the cavities of the teeth from being laid open by the removal of the bone, I will make a few observations on the wearing down of the teeth by mastication, to remedy which a similar process is set up. It often happens either from the particular position in which the teeth meet each other, from a deficiency in the structure of the enamel, or from some peculiarity in the food, that the surfaces of the teeth are gradually worn away, until not only the bony structure is left unprotected by enamel, but at length the cavity itself would be exposed, but for a deposition of bone which is formed within it, in proportion to the external abrasion of its substance. The new bone is darker and more transparent than the original substance of the tooth, but nearly of the same degree of hardness. It is first deposited in that part of the cavity towards the worn surface, and becomes gradually more and more filled as the tooth becomes abraded. This process, as Mr. Hunter well observes, proves to demonstration that the opening at the extremity of the root does not close from age, except with the actual obliteration of the cavity by a fresh deposition of bone: for it is, undoubtedly, from the vessels of the internal membrane, supplied through that foramen, that this new bony matter is formed.

As it must occasionally occur that the enamel on some of the teeth, or even on some parts of the surface of the same tooth, is harder and more solid than on others, a corresponding inequality is found to occur in their gradual demolition; and some portions of the teeth will remain almost unaltered, whilst the antagonists are worn into corresponding depressions.*

That the gradual abrasion of the teeth may be materially influenced by the nature of the food, is proved by the fact that the teeth of sailors, who, during the greater part of their lives, are accustomed to live upon hard biscuits, are often found to be so much worn down by the constant friction produced by this diet, that a very small part only of the crowns of the teeth remains above the edge of the gum, yet no exposure of the cavities takes place, as they become gradually filled up by new bone, and still afford a solid and continuous surface for mastication.

* The state of the teeth is perfectly identical with that of the grinders of graminivorous quadrupeds, in which the deep abrasion of the bone, and the raised edges of the layers of enamel, are admirably contrived for the perfect comminution of their peculiar food. It sometimes happens that the hard edge of a tooth in one jaw meets its antagonist in the other, at a part which is much softer; and the consequence is, that the bone of the latter is worn away into a deep hollow, whilst the harder portion of the former, not being worn down in the same degree with the rest of the same tooth, is left projecting into the hollow which it has formed. I have seen this occur in the sheep to the extent of nearly two inches, so that the point of the projecting portion had rendered necessary a considerable depression in the alveolar process of the opposite jaw bone, to prevent continual injury to that part.

OF
SALIVARY CALCULUS,

COMMONLY CALLED TARTAR.

THE formation of a calculous deposite upon the teeth, in a greater or less degree, may almost be said to be universal ; for, although in many persons of sound health and temperate habits it is possible by care to remove it so immediately after its deposition, that the teeth are kept generally free from it, still I believe it is in all cases produced, and would accumulate but for constant attention to the proper means of its removal. It consists of a calcareous substance, which, when first deposited, is soft, friable, and readily crumbling under the finger, but gradually, and, as it were, by a kind of slow crystallization, acquires almost a rocky hardness. Its usual color is a dull whitish yellow, or buff, though in some cases it is dark brown or black, and in others has a greenish hue. It also varies in the character of its surface, being generally smooth, especially in those parts where the tongue is constantly acting upon it, but occasionally in other parts exceedingly rough and rugged. It is susceptible of being stained by any coloring matter frequently taken into the mouth during its deposition ; as, for instance, from smoking tobacco, or from the long-continued use of co-

lored gargles, especially such as are composed of articles which are not capable of perfect solution in aqueous menstua.

The teeth which are found to be most loaded with tartar are, the superior molares, on their outer surface, and the inferior incisores, on the inner surface ; the cause of which will be presently explained.

The mode in which this substance is produced, and the source from which its secretion is derived, have been variously stated and explained ; but the common opinion, that it is deposited from the saliva, appears, from every circumstance, to be undoubtedly the true one. A French writer has described, and with no inconsiderable self-gratulation on his imagined discovery, a set of minute glands in the gum, which, he concluded, were destined to secrete this substance ; thus, not only assigning a new and extraordinary office to what prove, in fact, to be nothing more than common mucous follicles ; but, assuming that to be a natural secretion, which is certainly to be considered only as the result of an unnatural and unhealthy action. I have already alluded to this little flight in a former part of this work, and it is not necessary to notice it farther. An ingenious author, of the same country, Mons. Delabarre, has, however, advanced another theory, which is too important to be treated thus slightly, as it involves also the mode of formation of all those calculous concretions which are found in various parts of the body, and to most of which the substance now under consideration bears no inconsiderable resemblance in its chemical composition, no less than its external characters and appearances.

The opinion of Mons. Delabarre is, that this substance is neither deposited by the saliva, nor secreted by any glands proper to that office; but that it is produced by the mucous follicles of the mouth, or, as he expresses it, “une exhalation terreuse et malade de la membrane muqueuse des gencives:” and in support of this theory, the author endeavors to prove that all other calculous concretions, whether urinary, arthritic, or of whatever other description, are produced by a similar action either of the mucous or synovial membranes. It is not necessary to enter into a detailed discussion of the subject, but it may not be altogether useless to examine the general merits of the question, first of all as it regards the most common and important situation in which calculus is found—the urinary bladder—and then, as it respects the analogous formation of the tartar of the mouth.

The principal, and indeed the only tangible argument of M. Delabarre, is founded upon cases in which the introduction of a sound into the bladder had produced a deposition of calculous matter upon so much of its surface as had *probably* been in contact with the mucous membrane, where no previous disposition to form such deposit had previously manifested itself; and hence he infers, that in consequence of the irritation produced by the sound upon the lining of the bladder, the vessels of this structure took on a diseased action, and secreted this earthy substance.

But the previous non-existence of calculus in the bladder cannot be deemed any proof that the elements of its composition had not been held in solution in the urine, requiring only the occur-

rence of any extraneous body in the bladder to serve as a nucleus for its deposition. This view of the subject is amply confirmed by the fact, that depositions, both of the lithic salts and of the triple phosphate, the bases of the usual varieties of urinary calculi, are constantly formed from the urine after its expulsion from the bladder.

It appears, then, that the analogy drawn from the formation of urinary calculi, is conclusive against the theory which M. Delabarre has employed it to support : and that salivary calculus, or the tartar of the mouth, is deposited in a similar manner from the saliva, is, I think, directly proved, or at least supported with the highest degree of probability by every circumstance connected with its formation.

The saliva is found, by chemical analysis, to hold in solution the very substances of which the deposition now under consideration is composed.

That tartar, or more properly salivary calculus, is deposited from the saliva, is supported not only by the analogy already referred to, but by positive evidence. It is invariably found, that its accumulation takes place in the greatest quantities exactly opposite to the openings of the salivary ducts. Thus from the saliva secreted by the parotid gland, and poured out by the stonionian duct, it is first and principally precipitated upon the outer surface of the superior molares ; and from that which flows from the sublingual ducts, it is deposited upon the posterior surfaces of the lower incisores. It has, in fact, occasionally been found occupying the ducts themselves, and I have seen a case of ranula produced by this circumstance, in which a portion of this substance had formed in a sublingual duct,

and, blocking up the passage, occasioned an enormous accumulation of saliva. The teeth of the lower jaw generally, are also more loaded with this concretion than those of the upper; which is a fact in perfect accordance with the present explanation of the mode of its production; for the saliva gravitating towards the lower part of the mouth, remains around those teeth in considerable quantities, in which they are, as it were, continually bathed. From these circumstances it is, I think, sufficiently evident that the earthy matter of salivary calculus is deposited by the saliva, in which it had previously been held in solution.

With the exception of gangrene, there is no kind of injury to which the teeth are exposed, so commonly and so extensively destructive as this concretion. As it is, generally, first of all deposited at the necks of the teeth, and especially underneath the free edge of the gum, its first effect is to excite more or less irritation in that structure, producing increased redness and sensibility, with sponginess and the separation of its edge from the necks of the teeth. As the accumulation increases, its effects keep pace with it; the gum becomes exceedingly painful, so as to render the ordinary operation of brushing the teeth almost impracticable, and thus, by inducing a neglect of the common means of preventing its accumulation, it becomes the unavoidable cause of its continued increase. Absorption of the gum and alveolar process is the next consequence, which gradually goes on until the teeth, losing their support, become loosened, and at length fall out. A temporary and fallacious support is sometimes produced

by a large quantity of tartar, which forms one continuous mass around the loosened teeth, and instances have occurred in which several teeth thus cemented together have come away without being separated from each other.

It has been already observed that the inferior incisors are more particularly liable to this concretion, and hence it happens that, although these teeth are almost entirely devoid of any tendency to gangrene, and are consequently very rarely attacked with that disease, yet there are scarcely any teeth which are so commonly lost as these.

In cases of great irritability of constitution and want of tone in the system, the irritation which is produced by this cause, frequently occasions ulceration of a very unhealthy character in the gums, cheek, or tongue. These ulcers are, in the gums, accompanied with an unnatural fungoid growth, great redness, and a soft spongy texture; they are very difficult to heal, and, in fact, are seldom benefited but by the removal of the irritating substance which had caused them, and free and repeated scarification. In addition to this treatment, it is also often necessary to administer alterative remedies combined with, or followed by tonics, and to apply powerful astringent lotions to the part.

As this substance is formed from the saliva, whatever cause produces an unhealthy action in the glands secreting that fluid, will be found invariably to occasion a greater deposition of tartar. Fever—indigestion, or any irregular state of the stomach—drinking, smoking, and similar causes of irritation in the salivary glands, whether local or constitutional, immediate or sympathetic, will produce it. The action of mercury is one of the most

speedy and unfailing causes of its accumulation, as it not only induces an increased and unhealthy action in the salivary glands, but also, by rendering the gums highly susceptible, prevents the necessary precautions from being used, by which the teeth might be kept clean.

The earthy matter of salivary calculus combines with a considerable quantity of the mucus of the mouth during its deposition; and, as the same causes which occasion its formation, will tend equally to produce an increased and unhealthy secretion of mucus, which, as it is thus rendered viscid, is with more difficulty removed, it often happens that this matter, already offensive from its diseased condition, becomes excessively fetid from putrid decomposition. Hence arises that peculiarly disgusting foetor which almost invariably accompanies the rapid deposition of tartar. If, however, the action which occasioned it be checked, this offensive smell gradually subsides, as the calculous deposite becomes consolidated.

It will be seen, then, from the foregoing statement of the effects of the deposition of salivary calculus, that not only our comfort and the healthy state of the mouth, but the use and durability of the teeth, are materially affected by it; it becomes, therefore, a question of no trifling consequence, in what manner its formation can be obviated, or, at all events, its accumulation prevented. In most cases, a due attention to the state of the stomach, and avoiding, as much as possible, every cause of the irritation which I have already spoken of as the principal source of its secretion, will do much towards preventing the production of tartar in the

first instance, though there are some persons whose constitutions are so prone to form calculous deposits in various parts of the body, that no precaution will wholly prevent it. Its accumulation upon the teeth can only be obviated by constant cleanliness, and by carefully removing it as soon as it is deposited, whilst it yet remains in a soft state.

When the disgusting effects of its accumulation are considered, it would appear impossible that any persuasion could be necessary to induce persons to obviate so great a nuisance, even on their own account; or, if they are too debased to procure their own comfort and cleanliness at the expense of a very little care and trouble, they surely have no right to shock the senses of others, who possess more delicacy and propriety of feeling than themselves. Yet so it is; and the sight and the smell are alike constantly outraged by the filthiness of people, who seem to obtrude their faces the closer in proportion to the disgust which they occasion.

The constant use of a tooth-brush will, in many cases, be sufficient to keep the teeth free from tartar. The brush should not be very hard, as it will not only be more difficult to clean the interstices between the teeth, the part in which the tartar is most likely to be deposited, but, by its friction, will occasion the gradual absorption of the gum, and the exposure of the necks of the teeth. The hair of the brush should be firm and elastic, and not too closely set. The teeth should be thoroughly brushed in every part, at least night and morning, and the mouth always rinsed after each meal. In those constitutions in which there is a particular tendency to form tartar, it will be necessary to

have recourse to some simple tooth powder, such as prepared chalk, or any other substance equally simple and soft ; it may, in some cases, be desirable to combine with it a small proportion of the bone of the cuttle-fish very finely powdered, and, if the gums are spongy and lax in their texture, a little alum, powdered myrrh, or bark may be added with advantage. Many of the tooth-powders which are offered for sale, with the promise of rendering the teeth beautifully white, perform, for a time, all that is promised, at the expense of permanent and irremediable injury to the teeth ; for they often contain a quantity of tartaric or other acid, which effects a gradual decomposition of the enamel. The use of acids to the teeth cannot be too strongly deprecated. Even where it is necessary to administer acid medicine, it is of considerable consequence that it should be taken through a glass tube, to prevent it from acting upon the enamel of the teeth. For want of this simple precaution, the teeth are very often irremediably injured by the use of this class of remedies.

The tartar is to be removed by means of instruments adapted for the purpose, and commonly known by the name of scaling instruments. They are of several forms, accommodated to the different situations from which the tartar is to be removed, and should be highly tempered, and the edges kept sharp and hard. It is of consequence that every particle of it should be taken away, not only from the external and internal surface of the teeth, but also between them ; for if it be suffered to remain in any part, it forms a nucleus, around which a farther accumulation will be immediately deposited. When the tartar exists in

considerable quantities, and especially if the teeth are at all loosened, it is proper to remove it at different times, with an interval of some days, that the teeth may recover from the effects of the first operation before the second is performed; and in order that they may receive as much benefit as possible from this plan, the tartar which is formed around the necks of the teeth, and which has been the cause of the loss of the gum, and the consequent loosening of the teeth, should be first removed, which will allow of the gum being partially restored, and the teeth rendered, in some measure, firmer, and capable of bearing, without injury, the subsequent operations. In the mean time, this object will be much assisted by the frequent use of some astringent lotion, according to either of the following formulæ :

℞ Aluminis, ʒiss.
Tinct. Myrrhæ, fʒiii.
Mist. Camphoræ, fʒvss. Misce.

℞ Vini Rubri Lusitan.
Mist. Camphoræ, -ā fʒii. Misce.

℞ Infusii Rosæ, fʒii.
Decoct. Cinchonæ, fʒiv. Misce.

After the entire removal of the tartar, if the gums should still remain swollen and spongy, they may be occasionally scarified, and the lotions just mentioned may be continued for a time. When much heat and pain are felt in this part, I have known considerable relief afforded by a solution of nitre, with which the mouth is to be repeatedly washed.

R Potassæ Nitræ. ʒii.
Infus. Hordei. fʒvj. Misce.

The application of strong mineral acids, for the purpose of assisting in the removal of the tartar, is to be deprecated as excessively injurious, as it dissolves the enamel and the earthy part of the bone wherever it comes in contact with them. The immediate effect of the treatment is to render the teeth beautifully white, but, in a short time, the surface of the enamel being made rough, and, as it were, eroded, they become again discolored, and, if the application be frequently repeated, the bone is exposed, and gangrene is the inevitable consequence.

OF

DISEASES OF THE INTERNAL MEMBRANE.

WHEN the exquisite sensibility of the internal pulp or membrane, and the extreme delicacy of its organization, are considered, the frequent occurrence of inflammation in such a structure would be naturally anticipated; and the results of that inflammation might be expected to be severe, from the situation in which it is placed, surrounded on all sides by a hard unyielding substance, which allows of no expansion of the structure contained within it. The pain which always accompanies the inflammation of a part which is subjected to uniform compression, is of a peculiar and most severe description; and such is the case with the membrane now under consideration. The suffering occasioned by inflammation in a sound and previously healthy tooth is, in fact, of a very different character from that which is produced by the exposure of the membrane by fracture or by decay. In the former case, it is of a deep heavy kind, and wholly unaccompanied by those acute darting paroxysms which attend the exposure of the pulp; though, with that exception, it is scarcely more endurable than severe and continued tooth-ache, properly so called. Whenever a tooth becomes inflamed, from whatever cause, and the pain which I have now described occurs, the gum should be

repeatedly bled by leeches ; and, if they are early applied, and the bleeding be freely encouraged, the inflammation will generally be soon arrested, and no unpleasant consequences ensue. But it occasionally happens that the inflammation goes on to such an extent as to produce either alveolar abscess, or even suppuration of the pulp itself, and the consequent confinement of an increasing secretion of pus within the dental cavity. This constitutes the disease which Mr. Fox considered as resembling *spina ventosa*, though certainly it requires some stretch of the imagination to see the analogy between these two affections.

The matter, by its pressure, produces absorption in the parietes of the cavity, and at length finds an outlet by this means at the extremity of the root, the foramen of which is very greatly enlarged. The pulp has by this time become partially absorbed, and the remaining portion having mortified, the tooth also loses its vitality, and gradually assumes a darkish hue. The pus having now escaped into the extremity of the alveolar cavity, at which part the thickening of the periosteum and effusion of lymph had formed a solid organized mass, this becomes absorbed in the centre, and forms the sac of the abscess, which now differs in no respect from common alveolar abscess, excepting in its communication with the dental cavity. Absorption of the alveolar process and gum gradually gives an outlet to the enclosed pus, and a discharge continues afterwards to take place, which, from the mortification of the pulp, is so extremely fetid, as to form a tolerable diagnostic character between this disease and common alveolar abscess occurring from inflammation of the alveolar periosteum, in which

the pus is usually nearly inodorous, excepting when it has been long confined, or when the bone has become carious. On extracting the tooth, the only remedy when pus has once been formed, the tooth will generally be found absorbed in patches, not only within the cavity, but on the external surface of the root also, as in all cases of total necrosis of a tooth from any other cause. Should the tooth be retained, the opening made by the pus will remain fistulous, and the matter continue constantly to be discharged. The termination of such cases is, in fact, precisely similar to that of total necrosis, as already described.

OF FUNGOUS GROWTH OF THE INTERNAL PULP.

The exposure of the internal membrane by gangrene of the crown of a tooth is sometimes succeeded by a very remarkable growth of this substance. These tumors of the pulp are of two kinds; the one is exquisitely painful, retaining in this respect, as well as in texture, the character of the structure from which it is derived; the other is almost totally insensible. The first rarely increases to such an extent as to fill the whole cavity which has been made by decay, perhaps because it is seldom suffered to remain very long without being removed with the tooth, on account of the pain to which it gives rise. It is of very rare occurrence compared with the second species, to which I have alluded, and which is by no means uncommon. The latter is rather rapid in its growth, often filling, in the course of a few months, the whole cavity of a decayed tooth, so completely as to receive the impression of the antagonist

teeth in the other jaw. It is almost as insensible as healthy gum or integument, and generally produces no other inconvenience than that of bleeding readily, and sometimes profusely, upon being wounded or pressed. It is of a pale reddish color, somewhat resembling the gum, but of a much softer consistence. I have not found that the bare removal of this fungous growth is permanently useful; on the contrary, unless the tooth be extracted, it re-appears in a few weeks, and speedily assumes its former size and appearance. If it be merely cut away from the tooth, the hemorrhage is sometimes excessive, and not very readily stopped, though in this respect it differs very much in different cases. On the extraction of the tooth, the only remedy to be depended upon, the root will generally be found covered with spots of organized lymph, the result of inflammation. I have given a figure of a case of this disease,* in which the tumor filled the space previously occupied by the crown of the tooth, almost the whole of which had been removed by decay.

* Plate IX. fig. 5.

OF

DISEASES OF THE GUMS AND ALVE- OLAR PROCESSES.

THE greater number of the diseases which attack these parts are produced by the irritation arising from diseased or dead teeth ; and it is comparatively seldom that we see severe affections of the gum which can be said to be strictly idiopathic. The morbid effects which are produced by these causes are, however, modified by different constitutional tendencies, and are thus found to manifest themselves under very various forms of disease. Thus the same cause of irritation which, in a healthy person, would occasion only simple abscess, might, in a different constitution, result in ulceration of a decidedly cancerous type ; and, in others, in the production of fungoid tumours, or the formation of scrofulous abscess.

But, although it appears that local causes are most frequently the agents in producing diseased action in these parts, yet we find occasionally that similar affections are proved to arise from constitutional sources alone, by their attacking parts of the gum where no irritating local cause remains, or by their continuing unabated, after the removal of such teeth as might be supposed to have produced them.

Thus the subject divides itself into two distinct classes of diseases : those which are the result of local irritation, and those which arise from constitutional causes.

The occurrence of malignant ulcers, apparently attacking first of all the gums and alveolar processes, and spreading from thence to the body of the jaw-bone, the cheek, the antrum, the orbit, &c., is too frequent not to have attracted the attention of every surgeon who has seen much of disease. Whether the irritation produced by teeth, or whether any other source of local irritation, be the exciting cause, it is to the constitution that we must look for that predisposition, without which these severe and often fatal affections could not occur : and although, in some cases, the removal of the local irritant, in the very early stage of the complaint, may probably arrest its progress for a time, there is seldom much advantage attending it, after the neighboring parts have once become the seat of such disease.

Although the occurrence of malignant disease generally, may be said to arise from a specific constitutional predisposition, this tendency is undoubtedly brought into action by any cause which produces excitement and subsequent debility. A cachectic condition of the system, the abuse of mercury, and similar causes, will frequently bring it into action ; but perhaps no persons are more liable to its occurrence than those in whom the constitution is worn out by debauchery and intemperance, where the system has become irritable in proportion to its debility, and where the tone of the stomach has yielded to the effects of a long-continued course of incessant excitement ; and the disease assumes a more or less formidable character, according to the extent to which the constitution has suffered.

As these and similar diseases cannot, however,

be considered as depending upon the teeth, excepting as an occasional exciting cause, and as the subject belongs rather to the teacher of the general principles of pathology, than to so circumscribed a department as that embraced by the present work, I shall pass to those affections of the neighboring parts which are more intimately and necessarily connected with the teeth.

The connexion, in a state of health, between the alveolar processes, and the gum which covers them, is so close, that a corresponding relation might naturally be expected to exist in a morbid state : we accordingly find, that whenever one of these parts becomes affected by any kind of morbid action, the other so immediately exhibits signs of disease, that it is often difficult or impossible to ascertain in which structure it had commenced : and it undoubtedly happens in many cases, that the alveolar processes constitute the seat of disease, which only becomes apparent from the gum first exhibiting the external signs of its existence.

It is a curious fact, that absorption of the gum, whether accompanied by morbid appearances or not, never precedes that of the alveolar processes, at least so as to occasion denudation of the edge of the bone ; but on the contrary, the latter is, in all cases, removed first, and its edge is consequently never exposed, except in caries of the bone, or from accident.

A considerable absorption of the gum and alveolar processes, occasioning the denudation of a large portion of the roots of the teeth, is now and then found to take place, unaccompanied by any diseased appearance, and unconnected with any

obvious derangement of the constitution. In forming a judgment upon cases of this description, however, and even on those in which the loss of substance is associated with more or less of diseased action, it is necessary to recollect that the teeth are generally removed in old age by this identical mode, the destruction of their support by the absorption of the gums and alveolar processes ; and, as this first step towards general decay commences at very different periods in different constitutions, it may doubtless in many cases, even in persons not yet past the middle period of life, be considered as an indication of a sort of premature old age, or an anticipation, at least, of senile decay, as far as regards these parts of the body. It is not, however, always to be thus accounted for, as it is sometimes seen in young persons, and doubtless arises from the same causes as those presently to be considered as originating a similar loss of substance in these parts, when attended with more or less of diseased action. These discrepancies may perhaps be attributed, either to difference of constitution, or to the more or less remote period at which the primary cause of the affection, whatever it may have been, had occurred.

Although the gradual loss of substance in the gum and alveolar processes, occasionally takes place without any obvious local or constitutional morbid action, yet it is much more frequently produced by derangement of the digestive organs, or some other constitutional cause, either immediate or remote ; and it is then invariably accompanied by a diseased state of the parts themselves. As this disease is identical in its general character

with the affection commonly, but absurdly called scurvy of the gums, and as its treatment is the same, whether accompanied by rapid absorption or not; I shall consider them as merely one disease, modified by circumstances. Indeed, the sponginess and suppuration which occur in the scurvy of the gums are never wholly unconnected with absorption of the alveolar processes and gums, although in some cases its progress is very tardy, whilst in others its ravages are exceedingly rapid. The causes and the ultimate consequences are the same in both instances.

This disease is very frequently first excited, and afterwards kept up, by continued indigestion, or some affection of the stomach, constantly acting upon the system. In other instances the cause may have existed at a remote period; and the action, which was then set up in the gums, having become chronic, the local disease continues long after the cause which had produced it ceases to exist. Thus, an attack of fever, frequent pregnancies, and any other violent or repeated commotion in the system; but, more than all, the action of mercury carried to excess, will very often be found to have originally produced the disease, which survives its cause, in many instances, for a great length of time. I have seen numerous cases in which the action of mercury had apparently ceased soon after the cure of the complaint for which it was administered; yet, after the lapse of two years or more, the gums and alveolar processes have re-assumed a morbid action, and this has gone on to such an extent as to occasion the loss of the greater number of the teeth.

The local symptoms of the disease in question

resemble, in a great measure, those of all other diseases of the gums arising from irritation. The gums are spongy, turgid, and vascular, bleeding very readily on being pressed, and generally very painful to the touch. In some cases, the edges only are thickened, the enlargement being distinctly circumscribed; in others, the swelling extends to the whole substance of the gum. The color is very much deepened, and of a purplish hue, with a slight degree of transparency, which gives a very peculiar appearance, not easily described. If this state of the parts be suffered to remain unattended to, the symptoms gradually become more aggravated. The irritation extends to the interior of the alveoli, occasioning a thickened state of the periosteum, with a slight degree of loosening of the teeth, the pressure of which produces more or less pain. The alveolar or dental periosteum at length secretes a purulent matter, which is discharged at the necks of the teeth. The alveolar processes continue to be gradually absorbed; but so slowly, that, in some cases, several years may elapse without producing much alteration. At length, however, their absorption extends so far as no longer to allow of their retaining the teeth, which, one after another, spontaneously fall out. In general, the gum very speedily assumes a healthy appearance after the loss of these loose teeth; but I have seen a few cases, in which even the part from which the teeth have been removed, continues in an unhealthy state, which defies every local as well as constitutional remedy, which has been resorted to for its cure.

Sometimes the alveolar periosteum becomes so much inflamed, in consequence of the increased ir-

ritation produced in it by the loosened teeth, heightened, perhaps, by some constitutional irritability, that true alveolar abscess takes place, accompanied by many of the symptoms which will be found described as belonging to that disease, excepting that the swelling of the adjacent parts is seldom so great in the present case as in those which are produced by the irritation of an exposed nerve of a tooth, or by the existence of dead roots in the socket. This arises from the circumstance that the matter finds a much more easy and speedy exit, in consequence of the loss of a great part of the alveolar processes, and the more ready ulceration of the gum.

Although the symptoms which I have now described, may be considered as generally characterizing the origin and progress of the disease in question, yet we find that they do not necessarily belong to every case of alveolar absorption, even when accompanied by local disease. The loss of substance is sometimes rapid, and the discharge of pus from the alveolar periosteum considerable, without any high degree of inflammation occurring during any period of the complaint. The roots of the teeth are gradually denuded, and assume a blackish color; and a small quantity of pus may at any time be pressed out from under the gum; yet the edges of the gum are perhaps only slightly thickened, and the pain is inconsiderable. This affection is not confined to any of the teeth, but it occurs most frequently over the palatine root of the superior molares, which is often entirely denuded before the external roots are at all exposed.

Similar affections to those now described are

very often the result of the accumulation of a calculous deposite, called tartar; but as this has already formed a subject for separate consideration, I shall not notice it farther in this place.

The treatment of these affections is simple; but it should be prompt and decisive, in order to ensure any considerable benefit. It will, of course, vary with the degree of progress which the disease has made, and the severity of the symptoms.

The first means to be adopted is the free lancing of the gums. This operation is generally performed in a manner so indecisive and trifling as to produce but little benefit. It is restricted to the mere superficial scarification of the part, which, though it may be repeated from time to time, will totally fail of producing the effect for which it is employed. It is not upon the gradual abstraction of a certain quantity of blood that the advantage of this operation depends, but upon the sudden and perfect *unloading* of the vessels of the spongy gum, and the contraction of those vessels immediately consequent upon it. The best mode of fulfilling this object, is by passing a common lancet into the gum, carrying it between the teeth as low as the transverse alveolar processes will permit, and thus making a complete perpendicular section of each portion of gum: the lancet is then also to be drawn across the gum horizontally: and it will be found, if the lancet be carried sufficiently deep, that an immediate collapse of the vessels will take place; and this is to be rendered permanent by the frequent use of some strong astringent lotion. The following formula may be used for this purpose:

℞ *Aluminæ*, *Sulph* ʒij.

Decoct. Cinchonæ.

Infusi Rosæ ā ʒij. *Misce. Fiat lotio.*

The section of the gums should be repeated from time to time at intervals of a week, until the sponginess and inflammation have entirely subsided ; and the necessity for a frequent and continued use of this plan will, of course, depend upon the degree and obstinacy of the disease.

In all cases, it will be essential to pay particular attention to the state of the stomach. Mild alteratives should be first had recourse to, until the tongue has ceased to appear furred, and the bowels are restored to a perfectly healthy function : after which the greatest benefit will be derived from the use of tonic medicines.

OF ALVEOLAR ABSCESS.

Of all the diseases which attack the gums and alveolar processes, none is so common, and, perhaps, few are so frequently misunderstood, as that which is commonly termed gum-bile. The very name which is popularly given to it, is at once a proof of the mistaken notion commonly entertained respecting its nature, and the means of perpetuating the error. The gum is, in fact, only secondarily affected, the cause being invariably seated within the alveolus : I propose, therefore, to call it *alveolar abscess*, as more correctly designating its true nature and situation.

It is produced by various causes. Now and then, though very rarely, it is the result of inflammation in the periosteum of a sound tooth, from cold or

some other local cause ; or it may arise from mechanical injury to a tooth, as its being loosened or partially dislocated by a blow. The irritation of tooth-ache is also a common cause of its occurrence : but by far the most general is the existence of a dead tooth or root acting as an extraneous body in the socket.

From whatever source, however, the irritation may arise which produces alveolar abscess, the progress of the disease is, in all essential points, similar, and the indications of the treatment in every respect the same.

The first effect produced by the irritation of a diseased tooth, or a dead root, is a thickening of the periosteum of the alveolar cavity ; which raises the tooth in the socket, and renders it a little loose, and susceptible of considerable pain on pressure : an effusion of coagulable lymph then takes place around the extremity of the fang,* which becomes condensed into a sac, in the centre of which pus is formed. The sac will be found closely embracing the root just above its extremity, which is, as it were, bathed in the pus.

These sacs assume different appearances, depending upon the nature of the teeth upon which they have been formed. Thus, at the extremity of a round root, the internal cavity of which is simple, the sac is single, and of an oblong or pyriform figure : but in the case of its being formed upon a bicuspid tooth, the tooth of which is longitudinally contracted, so as to separate the internal cavity into two, having each a distinct foramen at the point, the sac is often double, and has the ap-

* Plate IX. fig. 6.

pearance of two small globular sacs united together.*

The irritation increases, and extends to the gum and neighboring parts, which become affected with severe throbbing pain; redness, and thickening of the gum, and at length a greater or less degree of tumefaction of the face occurs; and the pus, having occasioned by its pressure absorption of the investing parts, forms for itself an outlet, in some cases externally, either in the cheek, or opposite the base of the lower jaw, but more frequently within the mouth through the gum.

The enlargement of the alveolar cavity, produced by the pressure of the pus, is sometimes very great, and the external plate becomes absorbed to a considerable extent. Of this a remarkable case is preserved in the museum of Guy's Hospital, of which a figure is given.†

The suppuration which is thus produced, is not always confined to the alveolar cavity, or the parts immediately investing it. It is not an unfrequent circumstance to find a considerable enlargement in the palate, as high as near the centre of its vault, which is occasioned by a collection of matter in that part. In these cases the matter generally forms a passage between the two plates of the bone, producing a sinus, which sometimes extends to the distance of an inch or more from the extremity of the tooth which had produced it. Having, by its pressure, occasioned absorption in the inferior lamina of the bone, a tumor is consequently formed in the palate, which on the removal of the tooth, is found to communicate with the alveolar cavity, so that by pressing it imme-

* Plate IX. fig. 7, 8.

† Plate IX. fig. 9.

diately afterwards, the pus is discharged through the socket. This situation of the abscess occurs more frequently from an incisor, or a cuspidatus, than from the molares, though occasionally the latter are found to be the cause.

The treatment of this disease is, of course, similar in general to that required by abscess in any other part. In its incipient stage, when inflammation has attacked the periosteum, and before the formation of pus has actually taken place, leeches should be freely applied to the gum, the bleeding being afterwards encouraged by the continued application of warm water ; aperients, and a strictly temperate and cooling regimen, are also necessary. This plan will frequently succeed in preventing the formation of pus ; but if this should have already taken place, it is proper to encourage its advance through the gum, by fomentations in the mouth, and to prevent its proceeding externally, by cold applications to the face. As soon as the abscess has approached the surface, the pus should be evacuated. This treatment, however, is merely palliative, or at least of but temporary utility, for as long as the roots remain in the socket, the opening, through which the matter has passed, will continue fistulous, and a small quantity of pus will be constantly oozing through it, attended with more or less of sponginess and irritation of the gums, whilst a return of the severer symptoms is to be anticipated upon the recurrence of every local or constitutional source of irritation. Nothing, therefore, but the actual removal of the roots can permanently cure the disease.

The swelling which is produced by these causes, is, in some cases, excessively large ; and, in scro-

fulous constitutions, is very tardy in its cure, even after the removal of the cause.

Mrs. —, aged twenty-six, of a decidedly strumous habit, and, at the time when I first saw her, far advanced in pregnancy, had been attacked, three months previously to her consulting me, with severe pain in the lower jaw, in the ear, the submaxillary glands, and down the neck. Shortly afterwards the glands began to enlarge, and the face became at length enormously swollen, and resembled, in its general appearance, the most frightful case of *fungus hæmatodes*. The swelling, which extended over the whole side of the face, including the parotid and submaxillary glands, was hard and nodulated, and the surface here and there considerably discolored. The mouth was almost totally closed, so that it was only by applying so much force as to produce considerable pain, that I could open it even to the extent of a quarter of an inch. The dens sapientiæ was very much decayed, but it was impossible for me at this time, to get any instrument into the mouth, so as to extract the tooth with safety. I ordered six leeches to be applied immediately, warm water to be continually held in the mouth, a poultice to be placed over the side of the face, and a wedge of soft wood to be gradually forced farther and farther into the mouth between the teeth, so as to depress the lower jaw. Three days after, I found the mouth sufficiently opened to allow of the introduction of a small pair of forceps, with which I extracted the tooth. A small quantity of pus followed, mixed with the

blood, and a little thin sanious discharge had previously passed through a small hole in the external part of the tumor, and rather more freely through one in the gum. As the system was now greatly exhausted by continued pain, the want of rest and food, by the excitement dependant upon her particular situation, and by the reducing nature of the remedies which had been necessarily employed; a more generous diet was adopted, and tonic remedies administered, under which treatment the patient perfectly recovered, though it was several weeks before the swelling had entirely subsided.

When the matter has escaped through the external integuments, the reduction of the swelling is generally followed by a considerable depression or puckering of the skin over the part, a very singular result of which occurred in the following case :

In March, 1828, Mr. H. consulted me respecting the effects of an abscess which had been produced by the root of the right inferior dens sapientiæ. The abscess had been formed about two years before, and had burst externally, leaving a fistulous orifice, through which pus still continued to be discharged, and as the whisker had been suffered to grow over the part for the purpose of concealing the opening, considerable inconvenience and discomfort were produced by it. At this time a funnel-shaped depression existed in the skin, which could be seen to the depth of nearly three quar-

ters of an inch, and a small probe could be passed through it into the sac of the abscess underneath the root of the tooth. The abscess had now remained open for two years, during the latter of which the parts had been in the state I have described. I removed the tooth, and, as was anticipated, no farther secretion of pus took place ; but so perfectly had the communication been established, and so deeply had the depression extended, that, when the gum healed, it left, by its contraction, a fistulous opening, through which a portion of any fluid received into the mouth passed readily to the outside of the cheek, and I could with ease introduce a very fine probe completely through the passage. So free, in fact, was this communication, that some of the hairs of the whisker, with which the external portion of the depression was filled, grew through the internal opening, and appeared in the mouth.

I passed a very fine knife resembling the couching needle through it, and removed, as perfectly as possible, a circular portion of the parietes of the tube towards the gum ; but failed, in this and several other attempts to produce a union. It was, therefore, resolved that the whole parietes of the depression should be removed, extending the incision as far internally as possible, and the integuments then brought together as in a simple wound. In consequence, however, of the suppuration of a small gland in the immediate neighborhood, the operation was deferred until that should have been dispersed, and it therefore remains at present in the state in which I have described it.

Caries, and exfoliations of considerable portions of the alveolar processes, and of the body of the jaw-bone, are not uncommon results of the formation of alveolar abscess. Two cases are figured in Mr. Fox's work, in one of which a portion of the upper maxillary bone containing the central and lateral incisores, and the cuspidatus of the left side, exfoliated; and in the other a large portion of the substance of the lower jaw, with the two bicuspidates and the first molaris, which latter tooth had, by the irritation produced by the exposure of the membrane, occasioned the mischief. I have known many similar cases, though not in general to such an extent. Those given by Mr. Fox appear to have been occasioned by the obstinate determination of the patients, not to consent to the extraction of the decayed teeth which had produced the abscess, and the consequent burrowing of the pus. The same dread of the operation appears now to be very rare, whether from the advance of education in general, or more probably from the prevalence of an opinion, that the extraction of the teeth is greatly facilitated, by late improvements in the application of the instruments.

Another consequence frequently arises from alveolar abscess; namely, the formation of a small tumor around the fistulous passage through which the pus passes. When the opening of the abscess has taken place in the gum, these tumors are generally small and depressed; but in the cheek they occasionally assume an elongated conical form, extending sometimes to half an inch in length. I have seen many cases of this kind, in which, from

not being acquainted with the cause or nature of the disease, surgeons have removed the fungus with the knife, and afterwards endeavored to repress its reproduction with caustic and even the actual cautery, but without the least permanent benefit. The removal of the tooth is the only effectual remedy, and is always followed by the spontaneous disappearance of the tumor: it is however succeeded by a depression in the integuments similar to that which I have just described.

A distinct, permanent, unchanging patch of redness on the cheek, unaccompanied by pain, is an occasional consequence of the irritation produced by the causes now under consideration. Various appearances of this kind, differing in character and importance, according to constitutional influence, and other causes, are continually occurring. The following is however too curious an example to be omitted; though I regret that my notes of the case are too imperfect to allow of so minute a detail as I could have wished.

S. M. a servant in a gentleman's family, about thirty years of age, was affected with a superficial sore on the cheek immediately beneath the left orbit, of a very remarkable character. It was about the size of a shilling, of a black color, having very much the appearance of a portion of integument suddenly and recently destroyed by actual cautery. It was uniformly though slightly depressed, and distinctly circumscribed; and the edges of the surrounding skin were somewhat inflamed, though there was but little pain. Various applications

had been employed, with but little success, for the removal of the slough : poultices had been persevered in, alternately with ung. hydrargyri nitrico-oxydi, and arsenical ointment. Once or twice the slough had been removed, but it immediately re-appeared. At length the surgeon who attended her, sent her to me to ascertain whether any thing in the state of the mouth could have occasioned this singular disease. I found the second molaris of the upper jaw, on the left side, much diseased, and an enlargement immediately over the socket passing upwards towards the orbit, and thus indicating that there had existed some irritation extending in that direction. The tooth was therefore removed, and with the best effect. The part was again poulticed, but finding the adhesions of the slough very strong, I removed them with the knife, and it never re-appeared ; the part healed in the usual way, though somewhat tardily.

Arising from a similar cause, and possessing almost exactly the same characters as those of severe alveolar abscess, are those affections which arise from the irritation of a dens sapientiæ, when arising in the socket, where there is not sufficient room in the jaw for it to assume its natural situation. It often happens, that the formation of this tooth is delayed until the osseous system has become so entirely formed, and every part has so fully acquired its determinate size, that on the advance of the tooth, a corresponding elongation of the back part of the jaw does not take place, and the tooth

is compressed by the surrounding bone and the molar tooth. Under these circumstances, it usually takes a direction outwards, towards the cheek; but its progress is not only accompanied with a high degree of inflammation, which is often succeeded by the formation of matter to a considerable extent, but the crown of the tooth is pressed so forcibly against the cheek, as to produce thickening of the integuments, with inflammation and suppuration of the buccal glands, contraction and immobility of the muscles, and ulceration of a very unpleasant character, extending into the substance of the cheek. The following case will serve well to illustrate these effects, and to prove that nothing short of the extraction of the tooth which has produced them will be successful in effecting their removal.

Mr. E., a gentleman about twenty-five years of age, was the subject of disease in the internal part of the cheek, and in the gum, which had assumed a very threatening appearance. It was produced by the pressure of the dens sapientiæ of the lower jaw, which, in consequence of the want of space in the jaw, was forced outwards, towards the cheek, in a diagonal direction. This want of room appeared to have been partly occasioned by the second temporary molaris, a tooth of considerable size, still remaining in the jaw; the second bicuspid, always a much smaller tooth than its predecessor, having never made its appearance.

When I first saw the case, the crown of the tooth was completely buried in the substance of the cheek, the gum, and the loose, thickened in-

teguments of the back part of the mouth. The cheek was internally swelled and inflamed, part of it extremely hard and its substance was nodulated, the elevations being very hard and somewhat circumscribed : these were doubtless inflamed buccal glands. The enlargement extended considerably forwards, and received a perfect impression of the outer surface of the first and second molar teeth. The elevator muscles of the lower jaw were somewhat contracted, as they always are in cases of any considerable irritation from the displacement of a *dens sapientiæ*, so as to restrain the mouth from being fully opened. The pain was constant ; but there were occasional darting paroxysms, which were scarcely supportable, passing through the indurated substance of the cheek, and towards the throat. The gum was swelled over the internal and superior surface of the tooth, by means of which, and of its being externally imbedded in the cheek, it was entirely concealed. Suppuration had taken place underneath the gum, though not to any considerable extent. On attempting to pass a small curved steel probe around the crown of the tooth, I found it impossible to effect this, in consequence of the enlarged and constricted state of the soft parts in which it was enveloped : I therefore passed a sharp pointed bistoury, with the edge uppermost, underneath them, and made a free incision backwards and upwards, dividing the whole of that part which acted as a sort of a band over the tooth. As a proposal which I now made, to remove the *dens sapientiæ*, was decidedly negatived by the apprehension of my patient, I ex-

tracted the second temporary molaris, which had still remained in the jaw, and which was very closely wedged between the first bicuspid and the first permanent molaris; in the hope that, by degrees, some little room may thus be obtained. Six leeches were ordered to the cheek, to be followed by a poultice over the part; cathartic medicines were administered, and a strictly abstemious regimen enjoined.

On his next visit, a few days afterwards, I found the parts in nearly the same state, excepting that some slight diminution of the pain and inflammation had taken place. Pus continued to pass in small quantities, from underneath the thickened gum and integuments covering the tooth. The internal part of the cheek exhibited the uneven nodulated appearance, to rather a greater degree than before, and the general thickening of the surrounding part was certainly not diminished. I now pressed with greater earnestness the extraction of the tooth; but still without success. I therefore again made a free incision over the tooth, and directed the leeches, poultices, and aperient medicines, to be continued.

Mr. E. now went into the country; and a fortnight elapsed, without my having an opportunity of seeing him. On his return, I found the nodulated elevations in the cheek more prominent and circumscribed, and two of them had suppurated. I now prevailed upon Mr. E. to suffer the tooth to be extracted, which was immediately done. As there was no possibility of applying the forceps, in consequence of the great thickening and hardness of the surround-

ing parts, as well as the contracted state of the muscles, which prevented the necessary opening of the mouth, the tooth was removed by means of a simple elevator, with very little difficulty. This took place on the 25th of November, and after that time every symptom gradually ceased, and the parts have regained a perfectly healthy condition.

In the majority of cases, however, in which irritation is produced by the pressure of the *dens sapientiæ* in its advance, the symptoms are less severe, and are generally removed by the free liberation of the tooth, by making an incision through the gum that covers it. The cause of such affections, when they are not combined with actual deficiency of room in the jaw, is identical with that which has already been mentioned as producing the diseases of the first dentition. A similar indication is therefore to be fulfilled in the treatment of these cases, namely, the removal of that pressure upon the including parts, from which the irritation has arisen. In effecting this in the present instance, a somewhat different method is required from that which has been mentioned in treating of the former. The gum, it will be observed, is strained, as it were, over the back part of the tooth, and is usually in a highly sensitive state from inflammation. The pressure of a gum-lancet, without effectually cutting the gum, produces severe pain; to obviate which, and to make a more free and efficacious incision, I prefer the introduction of a sharp bistoury, resembling a common phymosis knife, with the point upwards: and when this is carried back under the bridle of gum till the point

is a little way beyond the tooth, the point is elevated, and, by the withdrawing of the instrument, a complete section is made of the gum, and of the integuments lying above it. The great advantage which this mode possesses over that usually employed, is sufficiently obvious. It is not, however, always sufficient to make a simple incision through the gum, as its immediate re-union often prevents the good effects from being permanent. It is necessary, in such cases, to remove a small portion of the gum from over the tooth; and this may be done either by the knife or by a pair of curved scissors, the part to be removed being held forwards by a tenaculum.

The bleeding from these operations very much relieves the inflammation, whilst the section or partial removal of the gum allows of the immediate advance of the rising tooth; and in these cases, as in the diseases arising from the first dentition, the relief is, in many cases, almost incredibly speedy and effectual.

OF

TUMORS ARISING FROM THE GUM AND ALVEOLAR PROCESSES.

THE tumors which spring from the gum are, in many cases, different from those which have a deeper seated origin, namely, in the alveolar process, or, when these have been absorbed, in the body of the bone. Generally, though certainly not without some exceptions, those which arise from bone, or from the periosteum, have more or less of ossific matter in their composition, whilst those which are produced in the gum itself, and confined to this connexion, are, I believe, always destitute of it. Some attention to this general rule will be found very useful in deciding upon the depth to which it will be necessary to carry the knife in the excision of these tumors, in order to secure their complete eradication; and it often happens that tumors, which, from the neglect of this diagnosis, have been merely removed from the gum, and which, by their speedy reappearance, have proved not to have been radically destroyed, will be found, by their containing at least spiculæ of bony matter, have had their seat in the bone, and therefore to have required a deeper excision.

Of the occurrence of fungoid, cancerous, and other malignant diseases to which these parts, in common only with the rest of the body, are liable,

I have already stated that it is not my intention here to speak ; but there are some species of tumor, which are either in their character confined to this situation, or are produced by the irritation from diseased teeth of which it will be necessary to treat with some minuteness.

The most common tumor of the gums consists simply of increased growth of this substance without any apparent alteration of structure. Whether this disease ever takes place without some irritation produced by a neighboring tooth, it is not in my power to decide. I have certainly never seen it occur in those parts of the gum from which the teeth had been wholly removed, nor is it usual to see it, without finding one or other of the teeth in contact with the part from which it springs, more or less loosened. This, however, may possibly be the effect rather than the cause, and in many cases doubtless is so ; for the usual, or at least the most frequent seat of its occurrence, is on the transverse process of the gum passing between the teeth.

Its first effect, therefore, and that which generally attracts attention to its existence, is a slight degree of separation of two teeth, in most cases by the partial yielding of one only ; and, on examination, the gum is found to be enlarged at this part, not only swelling between the teeth, but also pressed out, as it were, on the external and internal surface, though in other respects having a perfectly healthy appearance. Its progress is usually slow ; but, at length, if it be suffered to go on, the teeth upon which it presses become loosened, and are gradually displaced. I have more than once seen it extend from tooth to tooth until two or three had been lost ; but, in such cases, the part

in which it had commenced, and from which the teeth had been removed, ceased to show any signs of disease, and returned to its natural size and appearance, whilst the gum around the teeth on each side, was still considerably enlarged. This would seem to prove that the existence of the teeth is necessary to the occurrence of this disease; and, probably, some irritation produced by them in the gum is its invariable cause.

The simple excision of this kind of tumor is rarely successful. I have generally found that, however perfectly it may be taken away with the knife, if the loosened or displaced tooth be suffered to remain, a few weeks only will elapse before it makes its reappearance. It is necessary to remove that tooth which is most forced out of its situation by the pressure of the tumor, and then the tumor must be thoroughly taken away, the incision being carried quite down to the alveolar process. Should the least enlargement take place on the edge of the gum after a few weeks it should be carefully removed, and nitrate of silver applied every few days, till its recurrence is effectually checked.

In the spring of 1827, Mrs. C. consulted me respecting a tumor of this description, which existed between the central and lateral incisor of the lower jaw. It was at that time about the size of half a hazlenut on the external surface, and nearly as large on the internal; and the two teeth were slightly separated in consequence of the lateral incisor having yielded to the pressure. As the removal of this tooth was not agreed to by the patient, I contented myself with

the entire excision of the tumor, which was closely attached to the gum, both on the inner and outer surface, to the extent of its own size. The edges were afterwards daily touched with caustic, in consequence of their having very soon exhibited a slight reappearance of the disease. By persevering in this plan it appeared at last to be wholly removed, and the application was discontinued. Not more than two months afterwards, however, Mrs. C. again consulted me, and I found that the tumor had recurred, and was at this time larger than ever. The teeth were separated about the tenth of an inch, and the one which was displaced had become loose. It was, therefore, now removed, and the tumor again cut away ; but from a slight appearance of redness and thickening of the surrounding gum, the application of the caustic was, about three weeks after this second operation, again had recourse to for a few days. In six weeks after its discontinuance, the tumor again began to make its appearance on the inner edge of the gum ; surrounding the central incisor. This tooth was, at my earnest request, extracted, the enlarged part of the gum again cut away, and the caustic applied the next day. After continuing its application for ten days or a fortnight, it was laid aside ; and the disease has not since returned.

The gums are liable to a very singular affection, apparently unconnected with any known local cause, which consists of a general enlargement or thickening of their substance, accompanied with a preternatural degree of redness, and a glazed or

waxen semitransparency of the surface. The enlargement is generally most considerable at the edges, which, in cases where the teeth have been removed, instead of being gradually rounded off by absorption, as is naturally the case, are rendered exceedingly tumid or bulbous, being, in some instances, more than half an inch in thickness. The substance is firm and solid; and, though in itself of an unyielding texture, yet portions of it, which from the irregularity of form usually attendant upon this disease, are but partially attached, are somewhat loose and mobile. It is unaccompanied with pain or acute inflammation, nor does it bleed more readily than healthy gum; and it is so entirely chronic that it often remains without any obvious variation for years together. It is evidently unconnected with any disease of the teeth; nor does it depend upon irritation, produced by loose or dead teeth, or by tartar; for I have seen it exist to a very extensive degree where almost all the teeth had long been removed. It must, therefore, be considered as arising from a remote or constitutional cause, probably from sympathy with some disorder of the digestive organs, as it is generally found to be associated with a furred tongue and a peculiar viscidness of the saliva, though not apparently connected with any active disease.

Free and repeated scarifications, and even the removal of some of the larger portions of the diseased gum, followed by the use of strong astringent lotions, are the local means which I have generally adopted, though only with partial or temporary relief. The visceral derangement must first be corrected before any local remedies can be expected to be of much service; nor does it always hap-

pen that the most judicious attention to the state of the stomach will be efficacious, as this affection is generally produced by that chronic, and comparatively trifling dyspeptic state which continues for years, and sometimes through life without much variation ; baffling not only the use of medicinal remedies, but the utmost care and precaution in diet and regimen.

The irritation of a dead root remaining in the socket, over which the gum has gradually healed, sometimes occasions the formation of a tumor of a hard solid consistence, not unlike the gum in texture, but of a darker and somewhat mottled color. It first makes its appearance in the form of a small distinct patch of a purplish red color, immediately over the part where the root is concealed, and continues gradually to increase until the whole space, whether of one or of more teeth, is entirely occupied by it. Indeed its pressure will, in general, occasion the loosening and gradual displacement of the teeth between which it is confined. From its appearing over a part where a root remains entirely concealed by the gum, its cause very often remains unknown, and the tumor is repeatedly cut away, and caustics applied without the least permanent benefit ; until perhaps after a considerable lapse of time, and long continued and repeated suffering, the root which has occasioned the mischief, makes its appearance above the surface of the gum, or is exposed by the removal of the tumor. The base of this species of tumor is not generally confined to the part from which it takes its rise ; but extends entirely over the surface which is covered by the whole mass.

Hence, it is not always easy to remove it by ligature, which, but for this circumstance, would certainly be the preferable mode, as the hemorrhage consequent upon its excision, is frequently profuse and obstinate. If therefore its form and situation will allow of the use of a ligature, it is desirable to remove it by that means. As soon as it is entirely destroyed, whether by this mode or by the knife, the root should be carefully searched for, and extracted: without which precaution, a short time only will elapse before it re-appears with precisely the same aspect, and advances by the same steps as before.

I was some years since requested to see, in consultation with an eminent surgeon, a lady who was the subject of this kind of tumor to a considerable extent. It filled the whole space previously occupied by the three molares and the second bicuspid of the lower jaw, on the right side. It was not less than three quarters of an inch in breadth, and so deep as to have received the perfect impression of the corresponding teeth in the upper jaw. From its appearance, and the history of the case, for it had been removed and reproduced twice before, I considered it to be undoubtedly the consequence of the irritation of a dead root. The tumor was immediately removed by the knife, and after the hemorrhage had subsided, I succeeded in detecting a small portion of the root of one of the molares, just beneath the surface, from which the tumor had been cut. This was at once extracted, and the tumor never reappeared.

A species of enlargement, very nearly resembling that just described, occasionally takes place from some irritating cause in the periosteum or in the bone, without the intervention of any extraneous body. Although, however, the external appearance is very similar, its internal structure is essentially different. It possesses in parts a true cartilaginous character, often, though not always, interspersed with spiculæ of bone, and sometimes even with a patch of hard bony matter at its base, which insensibly passes into cartilage, and this, towards the surface, into gum, or a substance similar to it. This kind of tumor is extremely difficult to eradicate: its seat being in the bone, it is very seldom permanently removed, unless a small portion of the surface of the bone is also destroyed, either by excision or the application of caustic. I have known instances in which it has recurred after repeated and deep excision, which had been resorted to at different intervals for years; of which the following case will afford a good example:—

Mrs. W., aged thirty-eight, was the subject of this species of tumor, which occupied the whole of one side of the back part of the lower jaw, which the three molares had formerly occupied. These teeth had been removed some years previously. The tumor was about as large as the first joint of the finger, of a very firm hard texture, and entirely free from pain, excepting when accidentally pressed, when a darting pain passed through it towards the ear. It had been forming for about nine months, and had increased very regularly during the whole

of that period. I removed it with the knife, and a most profuse hemorrhage followed, which I found some difficulty in repressing. By continued pressure, however, it soon subsided, and I examined the part very carefully; but could discover no obvious cause for the formation of the tumor. In about a fortnight, the gum had healed, and assumed a healthy appearance, with the exception of a small spot at the back part about the size of a pea, which still retained the character of the tumor. I cut it away as deeply as I thought necessary, and applied caustic to the part, which was repeated every fourth or fifth day, until it had wholly removed the unhealthy appearance. A few months afterwards, it re-appeared at the same spot; it was again removed, the caustic re-applied, and with the same result. After having been three or four times baffled in the same manner, I at length produced exfoliation of a small portion of the bone, after which the gum became permanently healthy, and continues so to the present time.

The following case exhibits a different kind of tumor, which although like the former characterized by its cartilaginous structure, is covered by healthy, or apparently healthy integuments, and has not the same disposition to hemorrhage.

L. H., a healthy young man, had for some months perceived an irregular enlargement of the gum over the molar teeth on the left side of the upper jaw. It was hard and solid, connected by a very broad base with the jaw, and covered by gum and integument of a natural and

healthy color. A diseased molaris, lying beneath it, was removed and the tumor cut away by the surgeon who was then attending him. The hemorrhage was not profuse, and was easily suppressed. On examining the portion which had been removed, it proved to consist chiefly of hard cartilage, with here and there patches of bony matter. As the tumor had been but partially removed, it happened as I anticipated, that in a few weeks he called again upon me to exhibit its renewed growth. I found it very nearly, if not quite, as large as before, and with the same irregularity of form, and the same healthy color. It evidently had no connexion with the socket of the extracted tooth. I removed it as perfectly as I possibly could, and directed the patient to see me again in a week. He returned to the country, where he resided, and I regret that I have never seen him since, nor had any opportunity of learning the termination of the case.

Tumors from the alveolar processes produced by the irritation of diseased or dead teeth occasionally assume the external appearance of that swelling of the face occasioned by the commencement of alveolar abscess. I have a tumor of this description in my possession, which was removed some years since from the lower jaw of a young woman about twenty-one years of age. She had for some months been suffering severely, first from tooth-ache, occasioned by the denuded nerve of the second inferior molaris, and afterwards from inflammation in the alveolar cavity, and in the body of the jaw. An enlargement at length took

place externally, which led the medical gentleman at that time attending her, to suspect the presence of abscess; it continued to increase however, though very slowly, and without the least appearance of any formation of matter, until at length it assumed so large a size, and was attended with such severe and constant suffering, that its removal was decided on. It was at this time about the size of half a goose's egg. The tumor was accordingly removed, when it was found to consist of a mass of hard, semi-cartilaginous substance completely enveloped externally with a thin case of bone, which was slightly compressible.

OF THE

DISPLACEMENT OF TEETH BY DEPOSITE OF BONE IN THE ALVEOLAR CAVITY.

INDEPENDENT of the loss of substance in the gum and alveolar process, which has already been described, the teeth are frequently forced out of their natural situation by a species of exostosis, or deposition of bony matter within the sockets. This is generally confined to the teeth near the front of the mouth, and the incisores of the upper jaw are by far the most subject to it. The bone is deposited in various parts of the alveolar cavity, producing corresponding deviations in the position of the teeth. When it takes place only at the bottom of the socket, the tooth is thrust directly downwards, giving the appearance of a simple elongation of the tooth. At other times it is deposited on one side of the alveolar cavity, and the tooth is thrust towards the opposite side. Thus, if it occurs on the inner side of the alveolus of the central incisor, the tooth is thrown upon the lateral incisores, which it overlaps, and a space is produced between the two central incisores. This is rendered still more striking if, as is often the case, the two alveoli of the central incisores are similarly affected: the two teeth are, in that case, forced very much asunder, and the space between them is very obvious and unsightly. If the bony deposite

should be formed at the back part of the cavity, the tooth is made to project forwards, and very much overhangs the lower teeth.

It appears that this affection arises from some disturbance in the action of the vessels of the alveolar periosteum, which consequently deposits bone in patches ; and, from this view of its cause, it would appear that no remedy can be expected to be of much service. The abstraction of blood in the early stage has been adopted, but with very doubtful success. It has been usual to file the teeth in these cases, with the view of reducing them to the length of the others : nothing can be more incorrect than such a mode of treatment ; instead of remedying the evil, it increases it, by exciting to a still greater degree, the action of the vessels of the periosteum ; whilst it also shakes, and ultimately loosens the affected tooth, which had already in some measure lost its support, by being partially dislodged from the socket. I do not think that any treatment can be depended upon for checking this affection. The bony deposition will continue to be formed, in spite of all applications which may be made to prevent it, until at length, the tooth becomes loose and begins to excite irritation in the gums and alveoli. The bony deposit appears also to cut off the connexion between the tooth and the bone, by blocking up the foramina through which the vessels and nerves enter the alveolar cavity, and the tooth becomes totally killed. On removing it—an operation which will always be ultimately found necessary—the extremity of the root will, almost invariably, be seen more or less reduced in length by absorption.

In these cases, as well as in the denudation of

the roots from absorption of the gums and alveolar processes, they occasionally become blackened by exposure, and have a very disgusting appearance. This appears to arise from decomposition either of the surface of the bone, or of the periosteum which still covers it, and which is killed by exposure. From actual examination, the former is probably the true cause of the discoloration, which however is a comparatively rare occurrence.

OF THE

EFFECTS OF MERCURY UPON THE
TEETH, THE GUMS, AND ALVEOLAR
PROCESSES.

THE irritation produced by this powerful remedy upon different parts of the mouth, is so constant a result of its administration, as to afford a most certain criterion of the extent to which the constitution has become affected by its action. So prone are these parts to its influence in particular constitutions, that a single dose, and that in very moderate quantity, will frequently produce ptyalism. I have even seen five grains of pilula hydrargyri occasion swelling of the tongue, soreness of the gums, inflammation and thickening of the alveolar periosteum, and, consequently, temporary loosening of the teeth. From the very general use of this medicine, and still more from the careless and profuse manner in which it is sometimes administered, it may be considered as one of the most common causes of the diseases to which the teeth and their containing parts are liable. I have already alluded more than once to its influence, in producing a tendency to gangrene as well as total necrosis of the teeth—inflammation, and consequent suppuration in the alveolar periosteum—alveolar abscess—sponginess, ulceration, and absorption of the gums, the deposition of salivary calculus, &c. But these, although the most frequent

consequences of an excessive use of mercury, or of its more moderate administration under a peculiar idiosyncrasy of constitution, are not the only, or the most severe results. Caries and necrosis of large portions of the alveolar process, sometimes extending far into the body of the bone, are occasionally found to follow a profuse course of this medicine. In the diseases of infancy and childhood, mercury is too often administered by the mother or the nurse, with a degree of careless excess which ultimately, if not immediately, produces severe and irremediable injury.

A remarkable case of necrosis of the lower jaw arising from this cause, occurred to my notice some years since, the result of which affords a striking example of that remedial formation of new bone, which constitutes one of the most interesting processes adopted by nature for obviating the effects of disease.

A child about three years of age was brought to me, having a most extensive ulceration in the gum of the lower jaw, by which the alveolar process was partially denuded. The account given by the mother was, that the child had sometime previously been the subject of measles, for which a chemist, whom she consulted, gave her white powders, one of which was ordered to be taken every *four hours*. It appears by the result that this must have been calomel; for after taking it for two or three days, profuse ptyalism was produced, with swollen tongue, inflamed gums, &c., followed by ulceration of the gum, lips, and cheek. On examining the denuded alveolar process, I found that a consid-

erable necrosis had taken place, including the whole anterior arch of the jaw, from the first molaris on the left side, to the cuspidatus on the right. By degrees the exfoliating portion was raised, and became loose; when I found that it was not confined to the alveolar process, but comprised the whole substance of the bone, within the space just mentioned. It appeared, however, that as the necrosed portion became gradually detached, new bone had been formed underneath it, extending continuously from one side to the other, and forming a new chin. At length the loose bone came away, including the seven teeth above mentioned, and the rudiments of the corresponding permanent ones, and consisting of the whole section of the jaw with the entire chin. I directed that the jaw should be supported, and that mastication and all violent exertion of the muscles should be avoided for a time, the child being restricted to fluid food: and after a few weeks he ceased to experience the slightest inconvenience. When I last saw him, he was about nine or ten years of age; the face was but little disfigured by the loss, excepting from the want of the anterior teeth; and the chin had scarcely any appearance of deformity.

Sloughing of portions of the gum, accompanied with extensive ulcerations surrounding the dead part, is another consequence of excessive mercurial action; and the constitutional irritation which these sloughs excite during their removal, is sometimes very severe, from the state of excitement to

which the system had already been brought by the use of the medicine.

In cases of excessive sponginess of the gum whether accompanied with ulceration or not, in thickening of the alveolar periosteum, and other similar affections, no treatment will be found effectual, until the medicine itself is discontinued. The use of astringent lotions will be found serviceable, and the excessive and disgusting fœtor may be corrected by the frequent use of a wash composed of the chloruret of lime or of soda, very much diluted. It is not, however, whilst the mercurial action is still kept up in the system, that the only remedy to be depended upon for the permanent relief of the gums, can, with propriety, be had recourse to; namely, the free and deep application of the lancet. But when the medicine has ceased to act, and the swelling and other symptoms have assumed a chronic form, the vessels of the gums should be unloaded by carrying the lancet freely through their substance, down to the alveolar process; and the collapsed state of these parts may then be in a great measure preserved by the use of strong astringents. The bleeding should be repeated as soon as a return to the former turgid state is observed in the gum. If the lancet be used during the action of the medicine, the result will very often be the occurrence of unhealthy ulceration, which it will be very difficult to heal, as long as the mercury is persevered in.

However perfectly the effects of mercury may have subsided, even where no permanent injury appears to have been produced in the teeth, and where the common symptoms of its action have

entirely ceased to exist, it is not at all an unfrequent circumstance, that after the lapse of a longer or shorter period, sometimes even several years, the teeth become loose, absorption of the gums and alveolar processes takes place, and the early loss of the teeth is the consequence of an affection, the disappearance of which for so long a time, had persuaded the patient that all danger of subsequent injury had ceased. I have already treated of these and other remote consequences of mercurial action, as will be seen under the heads gangrene, necrosis, diseases of the gums and alveolar processes, alveolar abscess, &c.

OF

DISEASES OF THE ANTRUM MAXILLARE.

THE situation and connexion of this cavity are too generally known to require a detailed description. In a practical point of view, with reference to the diseases to which it is liable, it will be sufficient to glance hastily at its most prominent characters: namely, its roof formed by the orbital process, its floor by the palatine and alveolar processes, its external parietes by the cheek, and its internal by the nasal plate. In the latter a hole of considerable size exists, which, in the natural state, is nearly obliterated, being only large enough to admit the bulb of a common probe. It is internally lined with a mucous membrane, which is continuous with the Schneiderian membrane, communicating with it through the opening just mentioned, and through which also its secretion passes into the nose. The teeth which are placed immediately underneath its most depending part, are the first and second molares; and it occasionally happens that their roots extend into this cavity, and are covered, at their very extremity only, with the membrane lining it. Generally, however, their divergence is sufficient to embrace, as it were, the depending part of the antrum, which dips a little way down between the external and the palatine roots of these teeth. The close con-

nexion between the teeth and the cavity in question, accounts for the frequent occurrence of disease in its membrane arising from the irritation produced by diseased teeth.

In treating of the diseases of this cavity, it is not my intention to enter minutely into the consideration of those affections which are only incidentally connected with it, and which must be attributed originally to a specific constitutional diathesis, as fungus hæmatodes, cancer, &c. : for, although the tendency in the system to these diseases is doubtless not unfrequently brought into action by the local irritation arising from diseased or dead teeth, yet the diseased actions themselves are so entirely constitutional, and every organ and structure in the body, without exception, so generally liable to their attacks, that they can scarcely be considered as coming within the limited province of this work.

But, on the other hand, the antrum is continually liable to attacks of inflammation, of altered secretion, of abscess, and of consequent caries—arising, almost invariably, from the irritation produced by the teeth—and the treatment of which is so intimately connected with that of these organs, as to be universally considered as forming a part of the legitimate object of this branch of practice.

Were it necessary to adduce a single proof in addition to those already mentioned in the course of this work, of the imperative necessity of consigning the care of the teeth to persons whose surgical education has not been neglected, it would surely be impossible to adduce one more striking

and satisfactory, than the consideration of the diseases just mentioned, and the intimate connexion between them and the diseases of the teeth, in the light of cause and effect. Yet it is not less true than it is disgraceful, that the public, especially in the country, are driven into the hands of the empiric, by the acknowledged ignorance of too many practitioners on the subject of these affections.

The mucous membrane lining the antrum maxillare is readily excited by any of the common causes of inflammation in such structures. Continuous as it appears to be and identical as it certainly is in structure, with the pituitary membrane of the nose, whatever causes of irritation occur in the latter membrane will often extend themselves to the former. Thus, in common catarrh, a dull heavy pain is occasionally felt in the antrum, which, though generally trifling, is sufficient to indicate, with considerable probability at least, the production of inflammation by continuity of structure. This slight affection, however, is seldom attended with any more severe symptoms, than temporary and inconsiderable pain, which always subsides on the disappearance of the catarrh, and which may be readily relieved by the application of leeches to the side of the face. I have never known an instance of abscess arising from this cause alone, though the secretion is occasionally thickened, and its transparency somewhat clouded.

But, when inflammation of this cavity is produced by a tooth—whether from the exposure of its internal membrane, if the tooth be living; or, if dead, by the irritation which it excites as

an extraneous body—it often assumes a more severe and important character, both in its present symptoms and its future results. The teeth which are most commonly found to occasion inflammation in the antrum, are, as might naturally be inferred from their situation, the first and second molares, and the second bicuspid; though it sometimes happens that the first bicuspid, or even the cuspidatus, and, still more rarely, the dens sapientiæ will produce this effect. When, from constitutional irritability, arising from derangement of the digestive organs, general debility, or any other cause, irritation is produced in the sockets of any of the teeth now mentioned, the usual symptoms which precede alveolar abscess, and which have already been described, are often followed by the occurrence of deep seated pain in the body of the bone, which, although generally of a dull, heavy, aching character, is frequently interrupted by acute lancinating paroxysms darting across the cheek towards the interior of the nostril, and backwards in the direction of the tubercle of the maxillary bone; this is accompanied with a greater or less degree of general tumefaction of the cheek, and with circumscribed patches of a florid color upon the skin; and these parts, as well as the integuments and periosteum of the surrounding bone, are more or less painful on being pressed.

The inflammation should be at once reduced by the free application of leeches to the cheek; the state of the stomach and bowels must be carefully attended to, and the tooth or root which produced the irritation, should be immediately extracted.

If this plan be adopted sufficiently early, the symptoms will immediately subside; but, if the inflammation should be suffered to remain unattended to, for any considerable time, the mucous secretion from the membrane becomes altered in its character, assuming gradually a purulent form. The natural opening into the nose becomes obliterated by the thickening of the membrane; and the parts thus brought into contact will, in some cases, become permanently united by adhesive inflammation. The consequence of this is, that the mucous secretion, whether natural or diseased, is retained within the cavity, and becomes the cause, not only of increased inflammation, but of enlargement of the cavity, and ultimately of caries of some part or other of its parietes.

The term abscess, as applied to the disease in question, has given rise to very mistaken notions of its nature, and not less erroneous principles of treatment. A reference to the structure of the antrum would appear to be sufficient to point out the improbability, to say the least, of the occurrence of abscess in such a situation. That a mucous membrane covering, in a thin layer, the whole internal surface of such a cavity, should become the seat of all the consecutive steps of true abscess, is a statement bearing on the face of it an obvious absurdity. The disease is, in fact, nothing more than an altered secretion of the membrane. In its healthy state, this fluid is exactly similar to that which is formed by the Schneiderian membrane; it is equally fluid, inodorous and transparent. The first effect of inflammation is to increase its quantity; and afterwards to render it thicker and more tenacious. It frequently be-

comes even glairy in its consistence ; but in this respect it is liable to considerable variation. At length it assumes an opaque whitish or yellowish color, and resembles in every respect true pus. Whether this change is confined to an alteration simply in the natural secretion of the part, or whether some of the mucous follicles may become the subjects of suppuration, and thus a mixture of mucus and of true pus be formed in the antrum, is, perhaps, in some measure doubtful. But that the former is most probably the true state of the case is, I think, supported by the gradual steps by which the secretion becomes changed, as described above. In proportion to the degree of inflammation which has existed—its duration—or the confinement of the purulent secretion within the cavity, it becomes more or less fetid ; and in cases where the nasal opening has been long closed, the foetor, when the matter is evacuated, is tolerable, even where no disease has taken place in the bone.

If I illustrate the true nature of this disease by pointing out its analogy to gonorrhœa, it will perhaps be better understood than by any other reference. They both consist equally of an altered secretion, the one of the pituitary membrane, the other of the mucous lining of the urethra ; both assuming a purulent form, though without any of the essential characters of true abscess. It is necessary to enter thus particularly into this part of the subject, as the indications of the treatment will entirely depend upon a correct understanding of the nature of the disease ; and, as an erroneous opinion on this point has in more instances than

one, within my own knowledge, given rise to the most mistaken applications for its cure.

But to return to the progress of the disease.—Although the alteration in the action of the secreting vessels begins to take place in some degree, almost immediately upon the occurrence of inflammation, it is usually a considerable time before the discharge of purulent matter sets all doubt to rest as to the real nature of the complaint. In the mean time, the symptoms which have been described as pointing out the existence of inflammation in the antrum, increase. The pain is more severe, the cheek has become more tumid, the redness of the surface is also increased, and at length, provided that the nasal opening has not been obliterated by the thickening of the membrane at that part, a discharge of purulent mucus, (if that name may be allowed,) takes place into the nostril; and this (from a cause which is sufficiently obvious—the gravitation of the fluid,) is increased when the patient lies on the opposite side. If the matter has still a free exit through the opening, it often happens that the disease remains in nearly the same state for a considerable time, with no other variation than the occasional increase or diminution of the discharge of matter, arising from alterations in the state of the health, from cold, indigestion, or other adventitious circumstances; and it is indeed very rarely that the bone is seriously injured, unless the matter becomes pent up within the cavity of the antrum. In some cases, however, where there is a tendency to scrofula, or in very debilitated constitutions, caries and exfoliation of the bone will take place even where the opening continues pervious; the result, in all probability,

of the partial destruction of the membrane by ulceration, by means of which the bone has been denuded.

Such is the usual progress of the disease, when the communication with the nose remains open; but if it should have been obliterated in an early stage of the complaint, the early symptoms vary considerably, and the disease assumes a very different character. The pain in the face is of a more severe and heavy kind, accompanied with a distressing sense of weight and internal pressure. The redness and tumefaction of the cheek increase, and, after a longer or shorter time, an enlargement of some part of the parietes of the antrum takes place. This shows itself in various parts. It usually occasions, in the first instance, a considerable contraction of the nostril on that side, both from the protrusion of the bone, and from a thickened state of the Schneiderian membrane, so that the nostril is frequently entirely closed. At other times the enlargement occurs in the palate, or in the cheek, immediately above the alveolar processes. This expansion of the parietes is occasioned by the continually increasing pressure of the confined matter, and the results of its continuance vary according to difference of constitution, as well as from local causes.

One of the most constant concomitants of the enlargement, or rather expansion of the parietes, when it occurs towards the roof of the mouth, is the loosening and displacement of the molar and bicuspid teeth. The gums are also found to be exceedingly spongy and thickened, and assume an uneven fungoid appearance. The teeth, in con-

sequence of the absorption or attenuation of that part of the jaw in which they are imbedded, gradually lose their support, and several of them are generally lost in the course of the progress of the disease. Under these circumstances, as there is no hope of their ever being restored to even a tolerably firm state, and as they necessarily produce more or less irritation, it is better that they should at once be removed.

The usual termination of such cases is caries and exfoliation of some portion of the bony parietes; and the most frequent situation in which this takes place, is in the cheek, though occasionally the alveolar floor of the antrum, or a portion of the bony palate becomes thus removed. The opening which is then made for the escape of the pus, continues pervious for a longer or shorter period: and if the nasal opening should still remain closed, after the contents of the antrum have thus been evacuated, the ulcer must necessarily become fistulous from the continued flow of the secretion through it, occasioned by the obstruction of its natural vent into the nose.

A considerable quantity of opaque, white, curdy, or flocculent matter, of a solid consistence, is often found mingled with the puriform discharge, the flakes of which are sometimes sufficiently large and solid to form an obstruction to the passage of the matter through the nasal opening. I have seen more than one case in which considerable accumulation had taken place in the antrum, accompanied with all the usual symptoms of this disease, and in which a sudden evacuation of the contents took place into the nostril, in conse-

quence of the pressure having overcome the resistance which had thus been offered to its escape. The discharge in these cases contained a large proportion of the flocculi, which were unusually large and solid. In one case the same occurrence was repeated more than once before the cure was commenced, and on each occasion the obstruction had evidently arisen from this cause. Even the opening which has been made through the alveolar cavity for the evacuation of the pus, and for the injection of the applications necessary for its cure, is occasionally blocked up by these flocculi, but they are generally removed by the injection, and cease to be formed as the membrane gradually recovers its healthy function.

It is not in all instances that the secretion assumes a purulent form. Cases frequently occur in which the only alteration which takes place, is a thickening of the mucus, which, though it remains transparent, becomes of a glairy consistence. This will, in fact, be generally found mixed in a greater or less degree with the puriform fluid ordinarily formed in this disease. It is, I think, generally the case, that where the fluid is glairy rather than puriform, the enlargement continues to increase to a much greater extent, though very slowly, without exciting the same degree of irritation, and without the same liability to caries and exfoliation. A very interesting case of this kind is narrated by Dubois, in which the enlargement was enormously great, having continued to increase from the age of seven or eight, when it was first noticed, until eighteen, when the fluid was evacuated. This state of the secretion appears to me

to arise rather from mere mechanical obstruction by the closing of the nasal opening, and the consequent accumulation and confinement of the mucus, than from any morbid action; and I have repeatedly found that the evacuation of the fluid has been followed by the restoration of the vessels of the membrane to a healthy action, without any injection or other local or general remedies. It is, however, in most cases, long before the nasal opening is re-established.

TREATMENT OF ABSCESS OF THE ANTRUM.

From the account which has been given of the nature of this disease, it will be obvious that the indications which are required to be fulfilled in its cure are threefold. The first is the evacuation of the contained fluid, in those cases where the nasal opening is closed; secondly, the correction of the diseased condition of the membrane; and, thirdly, the removal of such portions of bone as may have become carious.

The opening of the antrum for the purpose of allowing the escape of the accumulated fluid, is generally a very simple operation. It consists in most cases of nothing more than the introduction of a trocar of suitable description into the antrum, through the alveolar cavity of some one of the teeth, which are situated immediately beneath it. The trocar which is generally used for this purpose, is bent at a right angle at about an inch from the point; but I have always found this a very inconvenient and tedious instrument. I have, for several years, used a perfectly straight one, with greater facility and expedi-

tion; and the direction of the alveoli of the upper jaw is so favorable for its introduction, that I have never found the least difficulty in opening the mouth sufficiently wide to enable me to avoid any interference with the teeth of the lower jaw, or with the cheek. The point is three-sided, and should be very sharp.

It is a question of some importance, to which of the alveolar cavities the preference is to be given for this operation. Should either of the molar or bicuspid teeth be diseased, its extraction is at once indicated for the purpose both of removing every source of irritation, and of obtaining an access to the antrum, without the sacrifice of a valuable tooth. But should all the teeth be free from decay—a circumstance extremely rare in this disease—or, on the other hand, should several of them require extraction, the most favorable situation for introducing the trocar, is the external alveolus, either of the first or second molaris. Should there be no opportunity of choosing either of these teeth, the second, or even the first bicuspid will offer a sufficiently practicable situation. I have indeed perforated the antrum through the alveolus of the cuspidatus; but in that case the trocar should be directed somewhat backwards, and the point should commence its entrance into the bone, before it reaches the extremity of the cavity. Its passage through the bone will therefore be deeper, and the operation consequently more tedious.

Having fixed upon the proper situation, the point of the trocar is to be pressed firmly against the bone, directed towards the antrum; the handle

of the instrument being firmly grasped in the palm of the hand, and by a rotatory motion, the bony partition between the alveolus and the antrum is gradually cut away. As there is almost always more or less inflammation in the membrane during this disease, the entrance of the point of the trocar may very generally be known by the occurrence of acute pain. The fore-finger should be firmly pressed against the side of the trocar during its passage, at a proper distance from the point, to prevent its being suddenly driven upwards against the orbit. Immediately on the instrument being withdrawn, a gush of the enclosed fluid, whether pus or glairy mucus, takes place into the mouth. It sometimes happens that the roots of a tooth penetrate into the very cavity of the antrum, or a communication is established between the alveolus and that cavity by the occurrence of alveolar abscess. In either of these cases, the fluid will follow the extraction of the tooth, and the opening thus made, will require only some degree of enlargement by the trocar.

The next step is the injection of such fluids as shall tend to alter the condition of the membrane, and excite its vessels to a healthy action. But as there is always considerable irritation produced by the operation of perforating the cavity, it is necessary that this should be reduced before any stimulating injections are administered. For the first few days, therefore, warm water is to be thrown into the antrum by means of a syringe having a curved tube; and, if necessary, leeches should be applied to the cheek, followed by cold lotions, and the bowels should be freely opened.

After the pain has subsided from this treatment, a moderately stimulating fluid is to be injected daily, or as frequently as the state of the membrane will permit. The composition of the injection, as well as its strength, may vary according to circumstances. A weak solution of sulphate of zinc, is perhaps preferable to any other; but it will be found that after a continued use of any one application, the part becomes so accustomed to its action, as no longer to be affected by it; and it may then be advantageously changed for some other. In the first instance, either of the following formulæ will be sufficiently strong :—

℞ Zinci Sulphat. gr. vj.
Aquæ Rosæ, f℥ vj. Misco.

℞ Cupri Sulphat. gr. iv.
Aquæ Rosæ, f℥ vj. Misco.

℞ Tinct. Myrrhæ, ʒj.
Decoct. Hordei, f℥ vj. Misco.

The strength of the injection is to be increased by degrees, so as always to occasion a slight sensation of heat within the antrum, for an hour or two after its application, but carefully avoiding such a degree of stimulus as would produce considerable pain, or inflammation. Should this effect supervene, leeches may be applied to the cheek, and the antrum may be injected with poppy fomentation. Such is the difference in the condition of the membrane in different cases, that I have in one instance been unable to use a solution of sulphate of zinc in the proportion of one

grain to an ounce, without producing severe inflammation and violent pain; whilst in another, I found it impossible to excite even the necessary degree of action in the vessels of that part, by a solution of the same salt, in the proportion of fifteen grains to an ounce of water; and even by undiluted port wine. In the former case the inflammation had been very considerable during the whole progress of the disease, and the constitution was in a most irritable state. The latter case presents several remarkable circumstances connected with its situation and the progress of its cure, which induces me to give the following detailed account of it.

Mr. B., about twenty years of age, of a florid complexion and in good health, applied to me on the 24th January, 1817, respecting a tumor on the left cheek. It had existed about four months, and was at this time about half the size of a pigeon's egg, and situated half an inch below the margin of the orbit. It was firm to the touch, and conveyed the idea that it consisted of simple effusion of lymph in the cellular tissue from previous inflammation, which, however, proved to be an erroneous impression. It had never produced the slightest pain, or inconvenience, nor was there any farther discoloration than a slight blush, scarcely exceeding that of the surrounding part of the skin. On examining the mouth, I found that the interior molaris on that side had suffered from caries to such an extent, as to have lost the whole substance of the crown, leaving only the roots

in the jaw ; it had, some months before, produced a slight degree of uneasiness, but no tooth-ache had ever occurred, nor had there existed, at any time, pain in the cheek, which could have led to the conclusion that the *antrum maxillare* had been affected. I immediately extracted the roots, and a considerable quantity of dark colored and slightly fetid pus instantly followed the removal of the anterior one. Observing, as I thought, an instantaneous alteration in the size of the tumor, I pressed it slightly with my finger, to which it immediately yielded, and a fresh gush of matter was thus forced into the mouth through the alveolar cavity. I then enlarged the opening into the antrum, by pressing a large probe through it, and injected some warm water, by which the tumor on the cheek was at once reproduced ; but again subsided on the water being suffered to return into the mouth. None of the water found its way into the nose, proving that the communication had become obliterated. On seeing this gentleman again on the 26th, I found that the opening in the alveolus had closed, and that the tumor had re-appeared : I therefore still farther enlarged it with the antrum trocar, and commenced the injection with a solution of sulphate of zinc in the proportion of 3ss. to a pint of rose water.

The injection was now continued daily, increasing the strength of the solution gradually, to the proportion of 3ii. to the pint ; and on the 11th of February the pus ceased to appear. On discontinuing the injection, however, it

was again formed, and the solution of sulphate of zinc was again had recourse to, and increased in its strength to half an ounce to a pint. Even this failed to check the formation of matter, and I substituted an injection composed of equal parts of port wine and water, which was also gradually strengthened until the wine was used without any dilution. It is very remarkable that during the whole treatment of this case, notwithstanding the strength of the applications, I failed to produce the slightest stimulating effect.

Particular attention was paid to the state of the bowels, and tonics were ordered, but the discharge of pus continued, though in very trifling quantity, until, in the course of the spring, Mr. B. went into the country, continuing the use of the port wine injection; and shortly after the secretion was restored to its natural state, and the opening into the nose became completely pervious. Up to the present period not the slightest return of the complaint has occurred.

It is a remarkable circumstance in this case, that pus should have been so long existing in the antrum as to produce a degree of pressure sufficient to occasion absorption of a part of its bony parietes, and have thus occasioned, for several months, a tumor in the cheek, without the least appearance of absorption or even of inflammation in the integuments. The sluggish state of the constitution shown by this fact, is equally evinced by the difficulty which I have already mentioned, in producing the requisite degree

of action in the vessels of the membrane, notwithstanding the strength of the stimuli which were applied.

I have never yet met with a case in which the opening into the nose had become closed by granulations, or at least, in which the cure of the diseased membrane did not ultimately restore that opening. There are cases, and they have more than once occurred in my own practice, in which the obliteration continued even for four years after the membrane had ceased to secrete puriform matter, and had, in fact, become perfectly healthy; in which cases the opening into the mouth was prevented from closing by the constant use of a small plug of wood, or of common wax bougie. Under these circumstances, I have repeatedly contemplated the perforation of the nasal opening by means of an instrument to be introduced by the nostril, and in one case I had procured such an instrument to be made for the purpose; but in all instances, I have found that the spontaneous re-establishment of the opening ultimately rendered any such operation unnecessary. I do not mean to assert that a case might not occur in which the obliteration may become permanent, but certainly such a case has never come within my own knowledge; and I have always considered it worth while to wait some time for its spontaneous restoration, rather than to have recourse to a difficult, uncertain, and, as I am inclined to believe, unnecessary operation.

After the nasal opening is re-established, and the secretion restored to a healthy condition, the opening which has been made by the trocar, through the alveolar cavity, will generally close

without any assistance. I have, however, occasionally seen cases, in which this has not taken place; and in these I have found it necessary to remove a small circular portion of the gum, as high up as possible within the tube, and then direct the lips of the opening to be as constantly as possible kept pressed against each other. A very efficient mode, however, of producing the necessary granulations for filling up the opening, is by affording a mechanical support to the edges of the tube, by means of a small gold plate.

I am convinced, that the importance of simple mechanical support in producing the obliteration of fistulous openings which are merely habitual, and where the causes which first produced them have ceased to exist, is not sufficiently appreciated; and I make no apology, therefore, whilst treating on the present subject, for introducing a few observations which bear upon this point. It is customary, in cases of defect of the bony palate, to supply the lost portion by means of a gold plate, which is either made to fit into the fissure, and fill the opening, or a portion of sponge or other substance is attached to it for the same purpose. The obvious tendency of such a plan, is to perpetuate the evil, to which, in fact, it does not profess to offer more than an imperfect remedy. By the application of a simple gold plate, without any projection into the opening, which is thus merely covered, and the edges supported, I have, in more instances than one, succeeded in producing a perfect obliteration of the fissure by the extension of the integuments of the palate, from every part of the circumference of the opening, until an entire union was produced in the centre. It was the

success of these attempts which induced me to adopt a similar plan in the following case, where an opening from the mouth into the antrum, of considerable size, continued to exist, though the nasal opening remained pervious.

Miss M., about eighteen years of age, had been the subject of fever; some months after which, the first superior molaris, on the left side, became loose in consequence of the absorption of the alveolar process, and after a time came away spontaneously. Shortly afterwards, that portion of the floor of the antrum maxillary which was situated immediately over that tooth exfoliated; leaving an opening directly into the antrum, nearly a quarter of an inch in diameter. Such was the state of the case, when I first saw the patient. The neighboring teeth were quite sound and firm, and the surrounding integument perfectly healthy; but considerable annoyance was experienced from the free passage of fluids into the antrum—from the inconvenience of eating on that side of the mouth, lest portions of food should be forced into the cavity—and from the facility of drawing air from the nose through the antrum into the mouth.

From the length of time which had now elapsed since the loss of bone took place—nearly two years—I certainly did not anticipate that the entire obliteration of this considerable opening would speedily be effected; but it appeared probable, that at least some diminution of its extent might be produced by the use of a gold plate, which should fill up the space between

the two teeth on each side : I therefore ordered such a one to be constructed, and fixed it, by means of a spring attached to the tooth on each side ; and after a very few months the edges of the opening came into contact, and became at last perfectly united, in which state they still continue.

Such, then, is the general treatment necessary in ordinary cases, of what has been called abscess in the antrum. That there are many anomalous cases which call for modifications of this method of cure, there can be no doubt ; but it is to be recollected, that the disease always consists simply of an altered secretion from the membrane, and that the term abscess is exceedingly incorrect. As well might gonorrhœa be termed abscess of the urethra, or catarrh of the bladder abscess of that organ, as the disease in question abscess of the antrum maxillare.

One of the most remarkable cases which I have ever seen, and which may perhaps be considered as a variety, at least, of this disease, I will now proceed to detail. It presents many anomalies, and is deserving of particular attention, as the only one, I believe on record, of a similar character. Its most remarkable feature perhaps is the situation in which the accumulation took place ; which is not only important from its singularity, but also as indicating the necessity for a very careful examination of the cavity, where the perforation is not followed by the immediate and expected flow of its fluid contents.

Mary B., aged eighteen, of an unhealthy and somewhat strumous aspect, of languid disposition, and of retiring and timid habits, came under my care on the 3d of January, 1817, in consequence of severe and continued pain on the left side of the face, of a dull heavy character, and, apparently, deep-seated; but occasionally darting in acute paroxysms, across the face towards the nose. The cheek was swollen, and the palate somewhat enlarged. About a year before the first superior molaris of that side had been extracted on account of severe pain in the face, but without producing any relief, and the pain was consequently attributed to rheumatism, from which complaint she had long suffered to a great degree, in the shoulder, hip, and other joints, and for which she had been under the care of many medical practitioners, both in London and Bath, having been sent to the latter place for the use of the waters. When I first saw her, the general health was much deranged: the stomach, bowels, and liver performed their functions very imperfectly; and the uterus partook of the general sluggishness of the system, menstruation being almost wholly suppressed, and the periods only indicated by increased indisposition, and especially by an exacerbation of the pain in the face.

No discharge had taken place from the nose, but, from the nature and situation of the pain, the direction of its paroxysms, the enlargement of the cheek and palate, and from an occasional trifling discharge of pus from the alveolus of the tooth which had been extracted, I could not doubt that the antrum was the seat of

the disease. On examining the teeth, I found that the second bicuspid also was diseased, and as it had at times occasioned considerable pain, I extracted it with the view of removing every possible source of irritation.

Six leeches were ordered to be applied to the face, and afterwards the continued application of a cold lotion. Medicines were also administered with reference to the general health, both as regarded the digestive and uterine functions; and on January 7, I determined on puncturing the antrum. I consequently introduced the trocar through the anterior alveolar cavity of the first molaris, and found that when the instrument came in contact with the lining membrane, the most acute pain was produced, indicating the existence of a high degree of inflammation in that structure. On withdrawing the trocar, when the antrum was freely opened, I was surprised, and a little disappointed, at finding that not the smallest discharge of pus made its appearance. There was a small quantity of glairy mucus, but nothing more. I introduced the blunt end of a probe, and found that the opening was quite free; but on passing it upwards towards the orbit, its passage was resisted by a firm elastic substance, which gave me the impression that a solid tumor existed in the upper part of the cavity, and which produced intolerable pain, on being pressed with the probe. I now injected some tepid water, and found that the nasal opening was pervious, as the water passed freely into the nose. As the operation had produced a considerable increase of

pain, and as the parts appeared a good deal inflamed, I ordered six leeches to be applied, the bowels to be freely opened, and an opiate to be taken at night.

January 9.—The pain has been extremely severe ever since the operation, with scarcely any mitigation, excepting for a few hours after the application of the leeches. A probe now introduced into the antrum, met with similar resistance, but much nearer the orifice than before, proving that the tumor had increased; and on injecting warm water, it no longer passed into the nose.

The leeches, the aperient, and the opiate were repeated.

January 11.—The pain has continued without cessation, and no sleep has been procured by the opium. The inflammation is not apparently reduced. Pulse one hundred, small and feeble. The palate is a little enlarged, but not more so than might be accounted for, by the thickening of the integuments by inflammation. I could now distinctly feel with a probe, that the tumor was not only increased in size, but that it had become softer, yielding in some measure to pressure, and conveying the impression that it contained fluid. I therefore introduced a sharp-pointed instrument, which, with a little force, pierced the tumor, and a gush of pus instantly took place, with immediate relief to the symptoms.

Here, then, was a sac containing pus, existing doubtless as a distinct cyst, the result of inflammation in the membrane; for it is scarcely probable that the membrane itself had become

separated from its attachment by the formation of pus between it and the bone. That the former was the true situation of the disease, may be inferred from the fact that no subsequent caries of the bone took place, which would undoubtedly, have been the case, had the matter been formed in contact with the bone; and it could scarcely have been produced between the mucous membrane and the periosteum, as these two structures, though essentially distinct from each other, are inseparably connected.

The pus continued to be discharged for a day or two, and then entirely ceased. On passing the probe a week after the former operation, I found the same resistance as before, and in the same situation; the cyst was again punctured, and again the pus was discharged. This alternation of the repletion and evacuation of the cyst regularly recurred for a considerable time, but the opening into the nose did not again become stopped. The general health, however, in the meanwhile, improved, and the pain in the face was greatly diminished, returning only, with any degree of violence, when the cyst was full.

At length the repeated perforation of the sac, followed by the use of strong astringent injections, and aided by the remedies which were directed to the state of the general health, restored the antrum to a healthy condition; the menstrual disturbance was by degrees entirely obviated, and the stomach at the same time assumed its healthy function: but it was two years from the time when I first saw her, before

she had recovered her health, which, at the best was never robust.

OF CARIES OF THE ANTRUM.

The destruction of portions of bone by the pressure of the enclosed fluid, or by the separation of the mucous membrane and periosteum by ulceration, is by no means an uncommon result of the disease which has just been considered. It is generally, but not universally, seen to follow the long continued obliteration of the nasal opening, and consequent incarceration of the accumulated fluid: and it may, therefore, in most cases be considered as the result of omitting to have recourse, sufficiently early, to the proper method of treatment. There are cases, however, in which caries of the parietes of this cavity arise from syphilis, from the abuse of mercury, and especially from the application of this remedy in a cachectic state of the constitution, or during the existence of suppurative inflammation in the membrane of this cavity; of which latter cause of caries I have seen several well marked cases.

In caries of the external parietes of the antrum, arising from the accumulation of mucus within that cavity, an abscess is occasionally formed in the cheek, which, at first, appears to have no actual communication with the antrum itself; but at length, as exfoliation of the loosened bone takes place through this external ulceration, the cavity of the antrum is exposed. Such cases as these are not uncommon: but it does not always happen that exfoliation from this part produces exposure of the cavity; as in the following instance,

where the internal lining of the antrum appears to have become sound and continuous during the approach of the carious portion of bone towards the surface. It is to be observed, however, that, in this case, the caries was not produced by any pressure of enclosed fluid, as the opening into the nose was at no period obliterated. From the history of the case, I should be more disposed to believe that it was the result of a high degree of inflammation, produced by the first application of a stimulating injection, although of a much less degree of strength than I have generally used it.

May 9, 1820, Miss L. E., a young lady, nineteen years of age, of a delicate and apparently scrofulous constitution, consulted me respecting a tumor, accompanied with severe pain, which existed under the right orbit. The enlargement occupied the greater part of the cheek, extending from the orbit about two inches downwards. It was hard, very painful, and a large red patch occupied the centre of the cheek. In consequence of severe pain in the cheek, passing upwards in the direction of the frontal sinus, as well as towards the nostril, the first molar tooth had been removed a fortnight before, but some portion of one of the roots was supposed to have been left. The pain had existed to a greater or less degree for some months previously. On examining the mouth, I found the gum exceedingly inflamed and painful on being touched, but no greater enlargement in any part, than usually attends an inflamed state of these parts. As

the membrane was evidently in a very irritable state, I refrained from immediately perforating the antrum, and ordered leeches to be applied to the face; to be followed, the next day, by the use of cold lotions.

May 11.—The pain having in some measure subsided, I introduced the trocar into the antrum, which produced such extreme pain in passing through the membrane, as to occasion fainting. A rather copious discharge of glairy mucus, with a smaller quantity of *very fetid* pus followed; and on injecting the antrum with tepid water, the opening into the nose was found to be quite pervious. The evaporating lotion was ordered to be continued, an opiate to be given at night, and the bowels to be freely opened.

On the 12th, I found that the pain had been much increased within the antrum, though the external inflammation appeared considerably less. The opening into the nose continued pervious, and, on injecting, the pus which came away with the water, was excessively fetid.

On the 13th, I commenced the injection of a solution of sulphate of zinc, in the proportion of a dram to a pint, which produced so much pain and inflammation, that it was found necessary to apply leeches to the face, and to use every other means to check it. And as the alveolar cavity and membrane of the antrum continued highly inflamed, warm water only was thrown into the cavity for three or four days.

After this the sulphate of zinc was again resorted to, in a much more diluted state; and

by occasionally omitting it, and using warm water only, whenever any considerable pain followed its application, a recurrence of inflammation was avoided. In the mean time, however, an abscess formed on the cheek, and was opened; but no communication existed between this and the antrum.

By the 19th a decided improvement had taken place in the discharge from the antrum, and the fœtor had almost wholly subsided: the orifice of the external abscess healed as usual, and a trifling hardness and enlargement alone remained. Gradually the secretion from the antrum became perfectly healthy, and the opening through the alveolar cavity was suffered to close, after which the patient went into the country perfectly well. A few weeks elapsed before I heard of her, when I was informed that the antrum continued well, but that the external abscess had re-appeared, and a small portion of bone had exfoliated. From this period the complaint has totally ceased.

It is not always easy to determine at once the presence of carious bone in abscess of the antrum. The fœtor and appearance of the discharge will not constitute a sufficiently distinct diagnosis, since, as I have already stated, the matter which has long been confined within this cavity often becomes excessively fetid, and the character of the fluid also varies so much in different cases, that only partial dependence can be placed upon it. After the remedies already mentioned have been persevered in for some time, the existence of caries in the

bone will however be more distinctly ascertained, by the continuance of fœtor and of the ichorous nature of the discharge, which, in cases where no disease of bone has taken place, will always be found gradually to diminish, after the opening has been made, and the cavity regularly injected.

The distinction between caries and necrosis in these cases is perhaps scarcely admissible. The occurrence of the former in the parietes of the antrum, will probably be followed by the death and exfoliation of a greater or less portion of the bone.

The treatment of these cases is of course similar to that of caries and of exfoliation in other parts, as far as the difference of the local circumstances will permit. The excessively offensive character of the discharge will be very materially obviated by injecting a weak solution of the chloruret of lime or of soda; and it is to be doubted whether any applications are of farther use in expediting the exfoliation. In a bone of so irregular a form as the superior maxillary, the throwing off of a large portion will necessarily be exceedingly tedious, and its removal by mechanical means has been recommended. In some instances it may be necessary to assist in extricating such pieces as are closely wedged between other portions of the bone, especially if the constitution should be in a state which calls for a speedy removal of such a source of irritation and of exhaustion. But, in general, it is perhaps better to wait for the usual gradual process of its liberation, at the same time taking care to keep up the powers of the constitution.

OF TUMORS IN THE ANTRUM.

Although the occurrence of fungoid tumors in the antrum, must be considered as more or less dependent for their origin, upon a specific constitutional tendency, yet the exciting cause is so often connected with the irritation produced by diseased teeth or by their dead roots, that a few very general observations on this subject may not be misplaced here, though it must be confessed that I have little to offer which can lay claim to novelty, either in the history or treatment of those cases which have occurred to my notice. The obscurity which unfortunately characterizes the early stages of these tumors, prevents the possibility of our tracing their progress from their first formation, and deprives us of the opportunity of removing them at that early period, at which alone their radical extirpation can with any certainty be depended upon. Thus much only can be known of their early growth—that it is generally exceedingly tardy, and unaccompanied with pain sufficiently marked to call for particular attention. It is not, therefore, until the disease has proceeded so far as to be externally conspicuous, that the assistance of the surgeon is called for; and in proportion to the extent to which it has advanced, will be the improbability of its removal, even if practicable, being permanently successful. The early symptoms are of too slight and obscure a character, to be distinguished from those of simple inflammation, or the commencement of ordinary abscess, as it is called, of this cavity. After a time, however, the teeth become somewhat loosened,

the gums are very spongy, the cheek and palate are enlarged, or the nostril in some measure contracted. In this stage, the principal characters by which it may be distinguished from that protrusion of the parietes which is produced by the accumulation of fluid, are the irregular form of the protruded surfaces, the more spongy and diseased appearance of the gums, and the total absence of fluctuation. But even these characters are, in some cases, scarcely sufficient to distinguish the two diseases; as, in the other, the fluctuation is, in many cases, exceedingly obscure, or even imperceptible, except in an advanced stage of the complaint.

The progress of the disease after the period first described, is generally much more rapid. One part after another gives way to the pressure; the orbit is gradually raised, the eye either protruded or concealed, according to the part of the orbit which most readily yields, the nose is pushed towards the other side of the face, the cheek becomes excessively swollen, and the palate in a corresponding degree depressed; whilst the alveolar processes are also thrust far out of their natural situation, so as to prevent the mouth from being closed. At an earlier or later period of its progress, ulceration generally occurs in various parts of the face or mouth, from which a sanious discharge constantly flows, which gradually becomes more and more fetid and irritating. The disease, which in its earlier stage had possessed the character of an ordinary fleshy tumor, now becomes decidedly malignant, and, if suffered to proceed to this stage, is invariably fatal.

The examination of many examples of tumor in the antrum, has led me to believe that the bony masses of which they sometimes consist, are identical, in their character and origin, with that of which I have just spoken. The occurrence of true exostosis upon the bony parietes of the antrum has certainly never fallen under my notice ; and the designation of the bony tumors to which I have referred, by that name, is calculated to mislead, and to give a very false impression of their nature. The fact is, that very different degrees of ossific deposit are found in these formations. In some cases, it extends through the whole mass of the tumor, includes in its progress the maxillary bone, the orbit, the nasal and palatine bones ; which, one after another, become involved in one mass of loose, cancellated, bony matter. In others, on the contrary, the mass of the tumor consists of that fungoid, pulpy, or fleshy substance before described, the bone occurring in small patches only, consisting of nothing more than detached spiculæ. Between these two extreme cases every intermediate gradation is occasionally found. But the circumstance which more than all others proves that the ossific matter is not necessarily derived from the bony parietes of the antrum, is that, in the midst of the soft fungoid mass, are found patches of bony spiculæ, perfectly surrounded and insulated by the fungus. The variations which are observed in the character of these tumors, appears therefore to depend upon the accidental difference in the quantity of bony deposit, rather than upon any true specific distinction in their nature and cause.

In the treatment of these cases only one object is to be fulfilled, and that is, the total extirpation of the disease. In order that this should be successful, it is necessary, first, that it should be had recourse to at an early stage of the complaint, and secondly, that every particle of the diseased structure should be taken away. The opening should therefore be large and free ; and it will not be difficult to effect this, as the external parietes are generally so much softened by the disease, by the time that the nature of the complaint is sufficiently obvious to call for the operation, that the bone may be cut away without much force, by means of a strong hooked knife. After the removal of the fungus, and the cessation of the hemorrhage, which is often very profuse, any small remaining portions having even a doubtful appearance, should as far as possible, be removed by the knife, or if necessary, destroyed by the application of the actual cautery. Desault found it necessary, in a very interesting case, in which he performed this operation, to repeat the application of the cautery three times during the progress of the cure.

To the proper mode, and the necessary degree of heat at which the cautery should be applied, I have already alluded in a former part of this work. The object of its employment in the cases now under consideration, is the destruction of the root of the disease, and the immediate suppression of hemorrhage ; both of which are best effected by an intense degree of heat. The white heat should therefore be employed, as a less degree would require the instrument to be held so long in contact with the part, before it could produce the total destruction of the disease, as to excite severe inflam-

mation; whereas the application of the iron at a white heat, is so instantaneous in its effect, as to allow of its being immediately withdrawn, before the surrounding parts become injured by it.

The bold practice of the French surgeons in the treatment of these diseases, is worthy of our praise and imitation. The timidity which, until very lately, almost excluded the use of the actual cautery in this country, has been one cause, and that a very prevalent one, of failure in the treatment of some of these cases; but it is not so easy to account for the still more culpable dread, which has in so many instances prevented any attempt from being made to extirpate the disease; a degree of pusillanimity which is at once an opprobrium on the profession, and a fatal injustice to the sufferers, who thus abandoned to the unrestrained progress of the disease, are left to perish by a lingering and most painful process, without even an attempt being hazarded for their relief.

The application of arsenical preparations has been found very efficacious in repressing the growth of the species of tumor after its removal; of which the following case is a satisfactory example. I give it in the words of the intelligent dresser who had the care of the patient:

“James Woodly was admitted into Guy’s Hospital, September 4th, 1821, for a fungous exostosis which arose from the antrum maxillare, and made its way through the palate. After his admission he had the fungus removed two or three times, and a variety of caustic applications were afterwards made use of; notwithstanding

which the tumor re-appeared. At length Sir A. Cooper, after having made an incision from the corner of the mouth outwards, through the cheek, removed the tumor from a greater depth than had previously been effected. After this operation the wound in the cheek readily healed, and the following strong solution of arsenic was daily applied to the part from whence the tumor had been removed :

R. Arsenic. oxyd. alb. ℥vj.
Potass. Subcarb. q. s.
Aq. Distillat. ℥iv. M. ft. solutio.

The solution required to be diluted in the first instance on account of its occasioning him a good deal of pain ; in a few days, however, he used it of the strength mentioned in the formula. It was applied regularly every afternoon, after which he did not take any food until the following day. At the time of its application he had a piece of oiled silk, of a horse-shoe shape, passed into the mouth, its sides being turned up to prevent the solution escaping into the mouth : his head then hanging down over a basin, a piece of sponge moderately saturated with the solution was applied to the disease upon the oiled silk, and, by his fingers introduced behind the oiled silk, pressed against the part ; such of the solution then as was pressed out, passed along the channel of the oiled silk into the basin over which the head was hanging, and the saliva escaped behind the oiled silk into the same utensil. He kept the sponge in this situation until it gave him considerable pain, when it was

removed and the mouth carefully washed. He suffered great pain in his mouth during the period of the cure; but the arsenic did not produce any other unpleasant symptoms. This application was continued for a few weeks, at the end of which time he was completely cured; a cavity being left in the site of the tumor, which however, gradually became covered by a continuation of the membrane which naturally lines the palate."

The species of tumor which I have now described, is that which usually attacks the antrum; but there are other kinds, of which individual cases are recorded, to which, in the present state of our information we can only refer, as detached and isolated facts. That a more accurate knowledge, and an approach at least to a correct classification, might result from a more diligent search into the history of the cases which are constantly occurring, and a more attentive investigation of their structure, either when extirpated during life, or in *post mortem* examination, is not to be doubted: and no case should be suffered to pass by unexamined and unrecorded, of which the details can be accurately and minutely described.

EXTRACTION OF THE TEETH.

THE operation of extracting the teeth, though not unfrequently consigned to persons who have no pretensions to professional knowledge, and, in many cases, even to the lowest mechanics, is one which nevertheless requires, for its judicious and safe performance, as much care and firmness, and as correct an acquaintance with the anatomy of the parts concerned in it, as many of the operations of surgery, to which a much higher degree of importance is commonly attached. That, in by far the majority of instances, this operation is performed by mere mechanical force, without any very serious consequences occurring, may perhaps be granted; but it is no less true, that even in the most simple cases, the pain of the operation is greatly diminished by a judicious choice and application of the instruments; whilst the frightful results which sometimes accrue from the employment of ill-directed violence, forcibly point out the necessity of some degree of surgical skill to render it at once safe and successful. Every country village has its stories of the loss of portions of the jaw-bone—the extraction of sound teeth in mistake for the decayed ones—and various diseases which are attributed with greater or less truth to this cause, and for which, the barber or the blacksmith has to atone.

It is not, however, to these characters, or such as these, that the blame of the ignorant performance of the operation in question is exclusively due. The ill effects of that inattention with which medical men in general view the treatment of the teeth, are in no case more conspicuous than in this; and it therefore becomes a matter of some importance, to lay down such rules as may be useful to the profession, and especially to the young practitioner, as general guides in its performance; of which such modification may be made in particular cases, as the judgment of the operator may suggest.

If the following hints should appear to some persons to be too simple and general, it must be recollected, that I write for the general medical practitioner, and not for the dentist; and every one who has seen the multiplicity of objects to which the attention of that most important class of the profession is necessarily directed, and the incessant mental anxiety and harassment, as well as bodily fatigue, which their duties impose upon them, must acknowledge how desirable it is, that the suggestions which may be offered to them upon such a subject as the present, should be as simple and concise as language can make them, and the instruments recommended for their constant use, as few and of as easy application as possible.

I shall not therefore occupy unnecessary space by a useless recurrence to the old methods of extraction, nor to the steps by which practitioners have advanced to the present very important improvements, both in the construction of the instruments, and in the mode of their application;

but proceed, first of all, to describe the instruments which are absolutely necessary for every general operator to possess, and then to consider the mode of their application to each separate class of the teeth. In doing this, I am aware that the practice which I shall recommend, will be at variance with that of many very successful and respectable practitioners; but as it is the result of my own individual experience, I have of course, the greater confidence in its correctness and general applicability.

The instruments generally required for this operation are the key instrument, various kinds of forceps, and the elevator.

The key which I generally use, is in most respects similar to that recommended by Mr. Fox, but simplified in its construction, and of much smaller size. The unwieldy length of this instrument, as it is usually constructed, is inconvenient and unsightly; and I have therefore been in the habit of employing one of much more moderate length, not only as more readily managed, but also as more easily concealed from the patient; a circumstance the advantage of which, those who have had much practice in this operation will readily appreciate. The whole instrument is not more than four inches and a-half in length, of which the fulcrum and the breadth of the handle occupy rather more than an inch, the shaft being therefore scarcely three and a-half—which is also about the length of the handle. The fulcrum is of an oval form, and the span of the claw should be of such dimensions, that when the fulcrum is placed perpendicular, the edge of the claw being brought so low, as to be

distant from the lower part of the fulcrum by exactly the breadth of the tooth to be extracted, the claw shall be nearly, but not quite, on the same horizontal line with the lower extremity of the fulcrum, the latter being about the twelfth part of an inch lower than the former. If this proportion be adopted, the part of the fulcrum resting upon the edge of the alveolar process, will be even with the claw embracing the corresponding part of the tooth on the opposite surface. The bearing of this fact will be further alluded to. The shaft of the instrument should be raised from about an inch in advance of the handle, nearly to the claw; to prevent pressure on the front teeth, when the fulcrum is placed on the inner side of the jaw.

The claw never requires to be placed in any other situation than immediately opposite to the fulcrum; the projection at the extremity of the instrument for fixing a claw beyond the fulcrum, as recommended by Mr. Spence, and the additional groove for fixing it on the hither side of the fulcrum, added by Mr. Fox, are alike useless and inconvenient. As the key-instrument is used for the removal of teeth of various sizes, it has been used to direct the application of claws of different dimensions, according to the diameter of the tooth to be removed. That this is occasionally necessary cannot be denied, as the same claw should not be used for a bicuspid as for a large superior molaris; but in other cases, where the difference between the teeth is not so great, the substitution of different claws is not necessary. The object, as has been already explained, is to preserve such a proportion between the claw and the fulcrum, as shall place these two parts nearly on the

same parallel, when separated to an extent equal to the width of the tooth intended to be extracted; and this object may be effected with sufficient accuracy, in most cases, by binding the fulcrum with a strip of lint, which may be more or less thick, according to the size of the tooth; thus diminishing or increasing the distance between the point of the claw and the fulcrum, when exactly opposite each other, with nearly the same certainty as if the size of the claw were altered.

This instrument is necessary for the removal of such adult molar and bicuspid teeth, as are not capable of being removed by forceps or the elevator. The temporary teeth never require the key.

The forceps must be of various forms and dimensions, according to the class of teeth for which they are intended. For the incisores, cuspidati, and even the bicuspidates of the upper jaw, a small pair, quite straight, will be found the most useful. For the upper molares they must be much larger, and the blades have a slight degree of curvature. But for the molares of the lower jaw, a very different construction will be necessary; the one blade overhanging the other, somewhat like the bill of a bird of prey, from which form I shall call it the *hawks-bill* forceps. The blades of all forceps should be hollowed at the edge, as nearly as possible to the curvature of the tooth to which they are to be applied, and hence it will appear obvious, that several of different sizes will be found very useful. The handles must be very strong, and broad, so as to fill the hand sufficiently when firmly grasped; and they should be so nearly parallel with each other, that when the blades

are open to a sufficient extent to receive the tooth, the handles should only be so wide apart as to allow the hand to be closed upon them with a firm and easy grasp.

The elevator is generally used for the removal of roots which remain in the alveoli after the destruction of the crown; though it will also be found exceedingly useful in the extraction of the *dentes sapientiæ*, and, in many cases of the incisors of the lower jaw, when they are so crowded together as not to admit of the application of forceps. The whole instrument is between five and six inches in length, of which the handle occupies two-thirds. The blade is strong, and terminated by a lance-shaped point, flat on one side, and tapering to the point on the other. The figure* will however give a better idea of the form of the instrument than any description could do.

It has been customary, previous to the extraction of teeth, to separate the gum from their necks, by means of the gum lancet; and this has been constantly recommended by those authors who have written practically on these subjects. That it is wholly unnecessary and useless, is apparent from the very slight connexion which subsists between the gum and the tooth; and were it even much more firm than it really is, the extracting instruments now in general use, would be found, in almost all cases, sufficient to effect this, at the moment of their being placed upon the teeth. That it can, in the slightest degree, facilitate the removal of the tooth from the socket, is too obvi-

* Plate XI. fig. 4, 5.

ously absurd to require refutation ; I therefore consider its employment as a useless addition to the pain and the fears of the patient, who will often exhibit as much timidity at this preparatory operation, as at the extraction of the tooth itself.

I shall now proceed to consider the mode in which the instruments, which I have described, are to be applied for the removal of each separate class of the teeth.

The incisores of the upper jaw will require the use only of a small pair of straight forceps, the application of which is extremely simple. As the roots of these teeth are conical, and generally perfectly round, they will require merely a slight rotation, and may then be drawn downwards, in the direction of the socket. The forceps should be placed as high on the root as the alveolar process will admit, and should be pressed so firmly as not to allow of the blades slipping upon the tooth, whilst at the same time, care must be taken that the pressure is not sufficiently great to crush the tooth.

The extraction of the inferior incisores is effected upon a very different principle. The roots of these teeth being very much flattened laterally, it is obvious that they cannot be extracted upon the principle of simple rotation in the socket. When the tooth to be removed is even, or nearly so, with the others on each side of it, the best instrument will be the hawks-bill forceps, of very small size, the blades being so narrow as to be adapted to the form of the anterior and posterior faces of the nar-

row and flattened neck of the tooth. The construction of the blades and their relative proportions should be such, that when opened to the extent of the tooth which they are intended to embrace, the two edges should be on the same parallel. The instrument being carefully fixed as low on the neck of the tooth as possible, a gentle but firm movement is to be made forwards, so as just to separate the tooth from the back part of the alveolar cavity, and then, continuously with this motion, the tooth is at once to be raised out of the socket.

But it often happens that these teeth require removal, on account of great irregularity in their arrangement, from want of sufficient room in the jaw; under which circumstances the forceps just described will, in many cases, be found inapplicable. I have generally found the elevator the most certain and effectual instrument for the removal of the inferior incisores, when so much crowded as not to allow of the application of the former instrument. It should be rather thinner than that which I have figured, as the extremity is to be inserted between the necks of the irregular tooth and the next to it, or in such other situation as the peculiar position of the tooth shall require. The alveolar process is to be made the resting place, and the face of the instrument is then to be turned upwards, so as to lift the irregular tooth from the socket. Some degree of lateral pressure upon the next tooth must, in many cases, take place during this movement; but if it be performed with proper caution, no injury is to be apprehended from this circumstance. When the tooth is thus raised by means of the elevator, it may readily be removed

with the finger and thumb, or the common small curved forceps. Should the tooth which it is intended to remove, be placed in a projecting situation in front of the others, as is very likely to be the case in irregularity in the anterior part of the lower jaw, the application of the small forceps just mentioned, of which the blades are bent at right angles with the handles, (the common small-curved paces of the instrument makers) will be found exceedingly useful. They are to be applied laterally, and after a sufficiently firm hold has been taken of the tooth, a slight and repeated motion is to be made in every direction till the tooth is loosened, and it is then to be extracted directly upwards.

The superior cuspidati and bicuspidēs may generally be removed by means of the same straight forceps as the incisores. The extraction of the former will be considerably facilitated, by giving a slight degree of rotation previous to its actual dislodgement from the socket, and it is rarely attended with any considerable trouble, if this plan be pursued. The bicuspidēs, on the contrary, having flatter sides, and less solid roots, will not allow of any degree of rotation; and must therefore be dislodged by first of all moving them a little outwards towards the cheek, so as to destroy the attachment to the inner alveolar plate, and then by a perpendicular pull, they may be drawn directly from the socket.

It is not in all cases, however, that these teeth will allow of this mode of extraction. When the decay has extended so far as to have removed great part of the crown, and made inroads even

upon the neck of the tooth, particularly towards the inner side, no method is so easy and certain as the application of the key instrument, with the fulcrum placed towards the palate. The claw should in this case be small, and the fulcrum may be covered with a strip of lint. In fixing the instrument, the edge of the claw should be inserted as far under the gum, upon the neck of the tooth, as the alveolar process will allow, and the fulcrum is to be placed on the edge of the inner alveolar plate, which serves as a solid basis on which it rests. A gradual and firm turn is then to be given to the instrument, combined with a slight perpendicular movement, which requires great steadiness of the hand and wrist; and by this combined motion the tooth will be removed without difficulty.

The cuspidati of the lower jaw are generally to be removed by the same means as the incisores; if the small hawks-bill forceps be employed, the external plate of the alveolar process will, in many cases, give way sufficiently to admit of the ready dislodgement of the tooth, without any material injury to the bone, or any subsequent exfoliation. Should the crown be too much destroyed by decay to allow of this instrument being fixed, the elevator must be used; and from the depth of the root, and the extent and firmness of its attachment, it will often require considerable force to effect its removal.

If there be any class of teeth which, more than others, exemplifies the utility of the key instrument, it is the bicuspidates of the lower jaw. In extracting these teeth, according to the plan for-

merly recommended, that is to say towards the outer side, the arch of the jaw would often interfere with the safe and proper application of the fulcrum; and this occasioned Mr. Fox to recommend what he considered an improvement in the key, namely, the addition of a groove for the claw on the hither side of the fulcrum, so that when the claw was fixed on the bicuspid, the fulcrum rested on the alveolar process of the first molaris. This occasions so great a loss of power, and renders the operation so uncertain, that I should consider it wholly inadmissible. I find, on the contrary, that by placing the claw in the usual position, opposite to the fulcrum, and fixing the fulcrum upon the *inner* side of the tooth, that the extraction is more readily and safely effected than by any other means. The claw should be rather small, and the fulcrum well covered with lint.

The extraction of the first and second molares of the upper jaw, will generally be effected with the least pain and in the most simple manner by means of the large forceps before described, slightly bent at the blades. In applying this instrument to the teeth in question, the edges must be thrust as far under the edge of the gum as possible, and a firm steady hold must be taken of the tooth. It is then to be dislodged by first a steady, gradual bearing outwards, until it is slightly moved, when, with a contrary motion into its former position, followed by a firm pull downwards, the tooth is removed generally with considerable facility.

It is necessary to be very careful that the pressure of the hand upon the handles of the instrument

should be just so firm as to allow of the necessary motion being given to it, and at the same time to avoid such force as would crush the tooth; a circumstance not always very easily prevented, where the decay is considerable and the roots very firmly fixed. The danger arises from the force which it is necessary to apply in order to produce the first movement outwards, which can scarcely be done without very great pressure of the handles, in order to prevent the blades from slipping off the tooth. It long ago struck me that if it were possible to fix the instrument immovably on the tooth, by any mechanical means, previous to the application of the moving force, a great advantage would be gained, and the danger just mentioned in a great measure obviated; as the hand would then be wholly at liberty to give the necessary motion, and would be rendered independent of continuing the hold of the instrument upon the tooth. I have at length succeeded in inventing a method by which this object is obtained. It is done by means of a graduated rack-work attached to one of the handles, falling by a spring into a catch projecting from the other handle; and thus when the instrument is closed so as firmly to embrace the tooth, it is impossible for it to slip off, or to move upon the tooth, and the attention of the operator needs only to be directed to the actual extraction. I have given a figure of this instrument,* and the simplicity of its construction will render it easily imitable. As I have now had considerable opportunities of judging of its application, I can with confidence say, that it has realized the object for which it was planned.

* Plate XI. fig. 1, 2.

In cases, however, in which the tooth which requires removal is very much decayed on either side, it is obvious that the application of the forceps is impracticable. A degree of pressure sufficient to remove the tooth, would inevitably crush the decayed crown to pieces, and the operation, so far as regards the instrument, is rendered completely ineffectual. It is in such cases as these that the key instrument will be found invaluable; and, notwithstanding all the opprobrium which has been unsparingly heaped upon it, and that by individuals who are glad to have a concealed recourse to its aid, when other means have failed them, I do in the strongest and most unhesitating manner, recommend it as the only one to be depended upon, when the forceps are found inefficient. In extracting the superior molares with the key instrument, the fulcrum should always, if possible, be placed on the inner or palatine side. The claw is to be pushed as far under the outer gum as possible, and the fulcrum rests upon the edge of the inner alveolar process. The turn which is then given inwards is to be accompanied by a movement downwards, which not only facilitates the extraction of the tooth, by bringing the force more nearly to the direction of the tooth, as it exists in the socket, but also prevents the fulcrum from rising upon the palate, during the turn of the instrument. The application of the fulcrum to the outer side, as recommended by most writers on this subject, appears to me to be a very important error. Not only is the instrument much more readily fixed in the situation which I have directed, but the basis on which the fulcrum rests is more firm and solid. If the fulcrum be fixed on

the outer alveolar plate, it will certainly pass upwards during the turn of the instrument, and fracture of the process is almost inevitable. On the inner side, on the contrary, there is a firm, solid, and sufficiently broad basis for the fulcrum to rest upon, and, as it is thus prevented from rising whilst the instrument is turned, the oval of the fulcrum presents a higher and higher portion to the place on which it rests, thus assisting the extraction in the very direction in which it is required. The experiment will in an instant explain my meaning much more clearly than description can possibly do.

The first and second molares of the lower jaw may, in ordinary cases, be extracted by means of the large "hawks-bill," forceps* which I have described, or by common forceps, the blades of which are bent almost at right angles with the handle. I generally prefer the former; and shall proceed to explain the mode of their application. I have already described the relative proportions between the longer and shorter blade, and the general form of the instrument. The longer blade is intended to pass over the tooth, and to be placed on the inner or lingual gum; and the outer and shorter blade is to be fixed to the corresponding part of the outer side. The operator places himself on that side of the patient from which the tooth is to be removed, and having taken a firm hold, the tooth is to be first moved a little outwards, towards the operator, and then, with a steady and continuous movement, drawn almost straight from

* Plate XI. fig. 3.

the socket ; a motion which the inclination of the handle will greatly facilitate.

In using the common bent forceps, the operator stands more directly in front of the patient ; but the direction in which the tooth is to be extracted, is nearly the same as in the former case. It is however certain that, in very numerous instances, the lower molares, from excessive decay of one or the other side, would not support the pressure of the forceps ; and then, as in those of the upper jaw, the key must be had recourse to.

It has long been a question which every operator decides according to his own fancy, or rather according to that method which practice has rendered most easy to himself, on which side the fulcrum should be placed for the removal of these teeth.

The direction in which they are articulated with the jaw, will I think indicate the outer side as the most rational and correct situation of the fulcrum. It will be recollected that these teeth in some measure overhang the inner alveolar plate, and therefore if the fulcrum be placed on that part, the force will be exerted at a great disadvantage, as the fulcrum will be situated very much below the parallel of the edge of the claw : the receding form of the lower part of the internal plate of the jaw, will also throw the fulcrum downwards when the turn is made, and the result will be that a larger or smaller portion of the inner alveolar plate will be broken away. The fulcrum should be placed on the very edge of the external alveolar process, and if the instrument be gently raised at the same time that the turn is given to it, the tooth will generally be removed with great ease.

The *dentes sapientiæ* of the upper jaw should seldom, if ever, be extracted with the key. The soft texture of the tuberosity of the maxillary bone renders it so liable to fracture, that examples are by no means unfrequent of exfoliation of this part of the bone, subsequent to the removal of the tooth in question by the key instrument, applied on the palatine side of the alveolus. The roots are generally so small, and placed so near to each other, that there is seldom any difficulty in removing the tooth by forceps; and even when it is so much decayed as not to allow of the necessary pressure, the employment of the elevator will be found sufficiently easy and certain. This instrument, which is particularly applicable in those cases, where neither the forceps nor the key can be safely employed, should be insinuated as it were, between the alveolar process and the root of the tooth, and when sufficient hold is obtained of the sound part of the root, it is to be turned out of the socket, resting the instrument at the same time upon the edge of the alveolar process, or even upon the side of the next tooth.

The *dentes sapientiæ* of the lower jaw are to be extracted by common curved forceps, or by the elevator; and the frequent deviation of the roots of this tooth from the perpendicular, in which cases they are almost invariably curved backwards, renders the latter a most useful instrument for their extraction: I find it indeed so applicable to these teeth, that for some years past I have comparatively seldom employed any other means for their removal.

When the crowns of any of the teeth are so entirely destroyed, that the forceps and the key are

alike insufficient to remove the roots which remain, the elevator will be found a very simple and certain means to effect it. I have already given some general rules for its application in particular cases, and the same principle obtains in those to which I am now referring. The edge of the instrument is to be inserted between the root and the alveolus, so far as to secure a sure hold, and the root is then to be lifted as it were from the socket, by resting the instrument upon the alveolar process, or even upon the side of a neighboring tooth. There is not the least danger of injuring the latter if care be taken not to depend too exclusively, nor to bear with too much force upon it.

It has in a very few instances occurred in my practice, that the root was so far decayed, as to render it impossible to reach it by the elevator, applied in the usual manner. In such cases I have successfully adopted the following method of bringing it away. A crucial incision is made in the gum, as nearly as possible opposite to the apex of the root. The gum is then separated from the bone, so as to expose a very small portion of it, which is to be cut away with the point of a strong knife till an opening is made into the alveolar cavity, and the end of the root is exposed. By placing the point of the elevator between this and the bottom of the socket, the root may be forced out through the natural opening of the alveolar cavity. In cases of alveolar abscess, combined with this state of the root, this plan may be very easily adopted, as the opening in the bone has been already effected for the escape of the pus.

The extraction of the temporary teeth is generally very easy and simple. Those of the upper jaw are to be removed by small straight forceps, and those of the lower, by curved ones. The superior incisores and cuspidati require a rotatory movement; the others, if the roots are not yet absorbed, are extracted by a slight motion outwards and inwards, after which they are readily lifted from the sockets; should the crowns be entirely destroyed by gangrene, the roots should be removed by means of a small elevator, exactly upon the same principle as that already laid down for the extraction of permanent roots.

OF THE ACCIDENTS WHICH MAY ACCOMPANY OR FOLLOW THE OPERATION OF EXTRACTION.

The most common accident to which an improper application of the instrument may give rise, is fracture of the alveolar process. As many of the molares occupy a considerably smaller space at the neck, where the edge of the alveolus surrounds them, than at the extremities of the diverging roots, it is obvious that no tooth of such form can be extracted, without more or less yielding of the alveolar process. This should, if possible, be confined to a simple fissure in that part towards which the tooth is moved; but even should a small portion of the bone be attached to the side of the tooth, and be removed with it, not the slightest injury is inflicted by such a circumstance, unless it should extend to the side of the next tooth, and partially denude it of its support. If the portion of alveolar process which is broken should still remain in the socket, attached to the inner part of the gum, it is better at once to re-

move it, which may be easily done with a pair of common dressing forceps ; otherwise it will excite considerable irritation for a considerable time until it has exfoliated. These, however, are trifling cases, compared to those which sometimes occur, from placing the fulcrum of the key instrument too low on the alveolar process, especially on the inner side of the lower jaw.

Mr. M., having suffered severely from tooth-ache, requested a young practitioner of his acquaintance to remove the tooth which caused the pain ; namely, the second inferior molaris on the right side. The fulcrum of the instrument was placed on the inner side, and suffered to sink below the alveolar process. After several very violent attempts, the crown of the tooth at length broke, and, at the same moment, a severe crush was felt along the whole inside of the jaw. The roots of the tooth were suffered to remain. A few days afterwards inflammation took place, and at length suppuration followed to a great extent. When I saw him the cheek was greatly enlarged, and the tumefaction extended under the jaw and down the neck. The elevators of the jaw partaking in the inflamed state of the parts, the mouth was with difficulty opened sufficiently for me to see the extent of the mischief which had been produced. I found very extensive ulceration along the inner side of the jaw, from the bicuspides to the *dens sapientiæ* ; an abscess had formed and burst, and large quantities of pus were constantly pouring from it. The whole teeth occupying the space which I have men-

tioned were loose, including the roots of the broken one; and upon examining the state of the alveolar process, I found that a large portion had been fractured, and was now exfoliating. The constitution was exceedingly reduced, and it was found necessary to order tonics and the most nourishing food to prevent the patient from sinking. At length the bone became sufficiently loosened to allow of its being detached, and when I removed it, more than two months after the accident, I found that it was so large as to have included the three molar teeth and both the bicuspidæ, some of which, having become loose, had previously come away. The part afterwards healed and gradually assumed its natural condition, leaving, however, a deep depression on the cheek. In this case, therefore, five teeth were lost, besides a considerable portion of bone, in consequence of the misapplication of the instrument.

The rules which I have laid down will, I trust, be found sufficient to obviate the occurrence of such accidents as this. That such a result should occasionally take place from an improper position of the fulcrum, is not to be wondered at. If this part of the instrument be placed half an inch lower than the edge of the claw, it will be obviously impossible that the tooth can be raised in the socket by any motion of the instrument. The direction of the force on turning the instrument when so placed, is inwards and downwards, and either the tooth, the bone, or the claw must give way. But, on the other hand, if the fulcrum had been placed on the edge of the external alveolar process,

the very construction of the instrument would have aided the removal of the tooth, as nearly as possible in the direction of the alveolar cavity.

A very severe and dangerous hemorrhage occasionally follows the extraction of a tooth. That this is, in some cases, the result of a hemorrhagic tendency in the constitution; in other words, of a want of contractile power in the coats of the arteries, seems clear, from the circumstance that some persons never have a tooth extracted without considerable hemorrhage continuing for a long time afterwards. Several cases are on record which have terminated fatally, notwithstanding every effort which was made to stop the flow of blood. The usual mode of treating these cases is to roll up a small bit of lint in a conical form, and to press it into the bleeding alveolar cavity, and then to produce pressure by a compress placed over it. These plugs are often imbued with styptics of various kinds, and caustic is occasionally introduced into the alveolar cavity. Failing these remedies, the actual cautery has been repeatedly used, and even the carotid artery tied, without effect.

When it is recollected that the bleeding vessel is situated at the very bottom of the alveolar cavity, it is astonishing that the simple method of applying pressure in immediate contact with it, which I am about to recommend, should not long ago have been adopted. The plugs of lint which are usually employed, are so clumsy and thick that they cannot be forced half way down the socket; and even if they are made more nearly to fit the cavity, the pressure which can be made upon them is very imperfect and uncertain. I have seen

many very severe cases, and some in which the patient had very nearly sunk from loss of blood ; but I never saw one in which I failed to stop the hemorrhage in a very few minutes by the following simple process. The bleeding alveolus is first of all to be ascertained, the coagulum carefully removed from it, and the interior cleaned by a piece of lint, and by rinsing the mouth with warm water. A strip of lint of sufficient length being torn off, one extremity of it is then to be introduced by means of any curved instrument which will reach the bottom of the socket, and pressed down to the very extremity of the alveolar cavity ; a farther portion is then to be forced upon the first, and so on until the cavity is filled, and every part firmly consolidated, by each portion being pressed upon, by the next above it ; when the cavity is thus filled and the lint rises rather above the edge, a compress is laid upon it, so thick as to be pressed upon by the antagonist teeth. The mouth is then to be forcibly closed so as to retain the plug in its place, and keep it constantly and very firmly pressed against the bottom of the alveolar cavity.

ON NEURALGIA, AND CERTAIN NERVOUS AFFECTIONS,

ARISING FROM OR CONNECTED WITH THE TEETH.

AMIDST the daily discoveries which the industry and ingenuity of modern physiologists are making in the laws by which the animal body is governed, their investigations have hitherto thrown but little light upon the functions of that mysterious system upon which every other action of animal life essentially depends, and which, while it communicates life and motion, sensibility and power, to every organ and to every structure, is in itself wrapt in the most profound obscurity. The nervous functions have, till lately, been the subject of the most crude and contradictory hypotheses ; contradictory not only to each other, but equally so to facts and to sound reasoning. The discoveries of Mr. Charles Bell, to which I have before referred, have, indeed, tended to simplify the subject by determining the distinct functions of sundry classes of nerves ; but the mode in which their influence is communicated to every part of the system, and the mysterious correspondence by which the most intimate relation is supported between one organ or function and another, or, in other words, the sympathetic impressions, of which these bundles of filaments are the media—these are subjects which still continue to be enveloped in impenetrable doubt and darkness.

Still, although the cause is yet hidden from our view, the fact is no less true and important, that in those affections upon which I am now about to offer a few observations, no less than in many others to which the body is liable, and which still remain amongst the most uncertain and satisfactory objects of medical skill, the effects of this *sympathy* (and I know of no better word by which to express myself) are continually placed before us, and constantly exhibiting the most interesting modifications of disease.

The subject of the ensuing observations, then, presents no exception to the difficulties which characterize the phenomena of the nerves, whether in a healthy or a diseased state: nor do I presume to offer any pretended addition to our knowledge of their functions. My object, in the present instance, is simply to endeavor to assist in forming some discrimination between two distinct forms of this painful affection, which have hitherto been confounded with each other, and thus perhaps lead to a more certain prognosis, and a less empirical method of treatment.

The term *tic douloureux* has, indeed, been employed to designate every painful affection of the nerves, to which an obvious and apparent cause could not readily be assigned, and has served but too often, like many other *names*, rather to conceal the ignorance of the physician than to distinguish the disease. The consequence has been, that instead of endeavoring to investigate the cause and the true nature of these affections, they have been confounded together without distinction, and a

purely empirical treatment has been almost universally adopted.

The practice which appears of late to have wholly superseded the division of the nerve, a remedy which, until within these few years, was generally employed in those cases in which it could be readily performed, would certainly lead to the supposition that it is considered by the profession generally as a constitutional disorder, and of an intermittent type.* There are, in fact, so many cases on record in which this form of the disease has been too strongly marked to be mistaken, and in which constitutional remedies, and those alone, have afforded relief, that it is not surprising that persons, observing this form only of the disease, or attributing other cases to mere accidental variation, should refer it invariably to constitutional causes alone.

* In a recent work, by Dr. Macculloch, on Marsh Fever and Neuralgia, *Tic douloureux* is indeed treated of as analogous to other disorders of an intermittent character. The ingenious and sensible author has claimed the meed of originality for this view of the disease; but, although I do not certainly remember any *public* announcement of such an opinion on the part of former writers, yet the universal practice of administering for this complaint various preparations of cinchona, arsenic, and other medicines, all of which are considered as almost *empirically specific* in intermittent fevers, has attested, in the most obvious manner, that the general impression has been, that the disease in question is essentially of an intermittent character. With regard to the opinion which I have given above, and the general view I take of the disease, I beg to state that this part of the text was written previously to my having seen Dr. Macculloch's work, nor was I aware of the doctrine which he has so powerfully supported. Although I differ from that gentleman in my general views respecting this disease, I willingly bear testimony to the practical usefulness of his work.

But, on the other hand, the fact of local pressure or other sources of topical irritation having been ascertained to exist in many well-marked cases, has given rise to the conviction, in the minds of many, that, instead of its being dependent upon constitutional disorder, its cause is for the most part, if not invariably, local. This opinion has, doubtless, gained ground, and received very plausible support, from the interesting facts lately developed by Sir Henry Hallford, who observed the peculiar amygdaloid thickening of the inner table of the skull, in several persons who had suffered from this disease.

Having for some years past paid no inconsiderable attention to the different forms of the complaint, I have long since come to the conclusion that two distinct affections—distinct in their causes, and equally so in the effect which different remedies are found to exert upon them—have been confounded under these terms; the one constitutional in its cause, and curable by general remedies; the other local, which, though occasionally relieved to a certain degree by such treatment, can only be permanently cured by the removal of the local cause, which, unhappily, often lies too deep to be within the reach of any operation.

It must be confessed that the symptoms of these two affections are so similar as to be readily confounded, and perhaps it would be difficult to lay down any one character which should infallibly distinguish the one from the other. There are, however, some general diagnostic symptoms which, after having seen many cases, will, I believe, en-

able the practitioner to decide with considerable certainty in any well-marked case.

In those which have a constitutional origin, periodical returns of the paroxysms are, if my views be correct, an invariable symptom. This may vary to a great extent, not only in the degree, but also in the regularity which may characterize the exacerbation of pain. In some cases the pain is incessant, and almost always equally severe; and it is only by careful attention, that its periodical increase can be ascertained. In others, not the slightest painful sensation is perceived during the twenty-four hours, with the exception of a distinct and certain period, which never fails, and never varies, and during which perhaps the agony is intense.

In the local disease, on the contrary, the pain is either continual, without any marked paroxysms of increased suffering; or the attacks are sudden, frequent, and interrupted by intervals of perfect ease, but recurring from time to time, and, in both cases, without any regular periods. This is the most obvious diagnostic character which has appeared to me to distinguish the two diseases. Farther observations may perhaps enable us to add other and more certain marks of distinction; but even this will, as I believe, be found generally sufficient to indicate the nature of the disease.

The practical importance of the view which I have taken of these affections—supposing it to be true—will be obvious, when it is considered that the remedies which are almost certain in their beneficial effects upon the one, will be either useless, or, at most, only partially effectual in the

other; and thus we may account for the very striking difference which every one who has seen much of the disease must have observed, in the result of medical treatment, of the most judicious kind, in these affections. I shall therefore offer some brief and general observations on the subject, considering the two diseases as distinct, and designating the one as local, and the other as constitutional neuralgia.

In the limited space to which I think it proper at present to restrict myself, in treating upon a subject which can only be considered as collateral to that on which this work is professedly undertaken, it is not necessary to enter minutely into a history of the disease, nor of the different modes of treatment which have at one time or other been recommended. I cannot however omit the remark, that the discoveries of Mr. Charles Bell have tended in one important respect to simplify the subject, by showing that one class of nerves alone is capable of conveying common sensation; and it appears to me, therefore a necessary consequence that the sentient nerves alone are susceptible of this painful disease. The portio dura of the seventh pair has been universally considered as one of those most frequently attacked by it; but as this has been shown, by the celebrated physiologist just named, to be a motor nerve, and as it does not appear that the nerves of one class can ever assume the function of those of another, it is clear that the complicated distribution of the sentient nerves of the face, has occasioned the error of attributing the seat of the disease to the branches of the portio dura.

OF CONSTITUTIONAL NEURALGIA.

The constitutional causes of neuralgia, and the condition of the nerves which are the immediate seat of the disease, are at present equally concealed. The most careful examination has hitherto failed in detecting any morbid appearance in the course of the affected nerves, nor have we any means of ascertaining in what manner constitutional causes act upon them, or why particular nerves should be more liable to these affections than others. In the present state of our information, an opinion upon this subject can therefore only be found on mere conjecture. The nature of the pain by which it is characterized is perfectly peculiar; and though it varies in different cases, not only in intensity but in the duration and frequency of those short, spasmodic paroxysms, by which the general periodical attack of the disease is, as it were, interrupted, yet the pain is still of the same indescribable and peculiar kind. I have already stated that I believe the periodical exacerbation of the pain, to be characteristic of the constitutional form of the disease. This, however, is not always easily or immediately observable. Sometimes the pain is incessant; and the only difference which can be pointed out between one period and another is, that at a certain time in the day an increased heat and fulness is felt in the part, and the pain becomes more severe; this is also often accompanied with a slight accession of fever. In other cases, the flashes of pain are felt at times during the day, but at a particular period they become more frequent; and, instead of being interrupted by intervals of ease, there is a general and incessant

sant pain during the periodical access of the complaint, which lasts for a greater or less time, from one hour to nearly half the day. But, in most cases, where no local irritation interferes with the intermittent character of the complaint, the whole of the day is passed in entire freedom from pain, with the exception of a regular and stated period of its exacerbation, during which the general pain is incessant, and accompanied with flashes of agony which are indescribably acute.

It is not to any one part of the body that a liability to this disease is restricted. The branches of the fifth pair of nerves are certainly the most frequently subject to it; but cases have also occurred in which the finger, the elbow, and various other parts have been the seats of the pain. I was myself the subject of it, in the left heel, for more than thirteen years, interrupted, however, by longer or shorter intervals of ease.

It appears that no cause operates more frequently in producing, or at least in increasing the disease, than any violent mental agitation, or long continued anxiety. Numerous cases have come under my notice, the origin of which could be traced to the loss of near friends and relatives, a sudden reverse of fortune, disappointment of long-cherished and ardent hopes, and similar causes of mental depression; and in almost all cases, such circumstances occurring during an interval of relief, or even after the disease has been apparently cured, will be likely to occasion its return.

There is one circumstance which it is of the utmost consequence to attend to in this complaint, and which is a universal attendant upon its at-

tacks, whether as a cause or a consequence. I mean a more or less deranged state of the digestive functions. I never saw a case of constitutional neuralgia without a white tongue; and I never knew one cured by any of the usual constitutional remedies, until the digestive organs were restored to a more healthy condition.

The treatment of *tic douloureux* has of late undergone a very material change. The introduction by Mr. Hutchinson of the carbonate of iron as a remedy, supported as it was by numerous cases in proof of its efficacy, occasioned its universal adoption for a time, and it had almost acquired the character of a specific, until its failure, in very many cases, led to more rational and limited expectations from its employment. It is certain that, with proper precautions, and especially after a particular attention has been paid to the state of the stomach and bowels, the carbonate of iron will, in many cases, be found exceedingly useful, but I have not found that, even with this necessary preparation, it is wholly to be depended upon. The quantity which it is requisite to administer, in order to produce any effect, is so large, that the stomach is loaded with it, and it frequently produces increased disorder of this organ. In many cases in which this remedy has failed, I have found the use of the sulphate of quinine completely successful. This admirable medicine, possessing all the virtues of the cinchona without the disadvantage of its bulk, by which the stomach was so often injuriously loaded, is one of the most important acquisitions in the treatment of this disease. I could mention numerous examples in which it has

been entirely successful, and many others which have been materially benefited by its use ; but the following case, in which no other remedy was employed, will be sufficient :—

Mrs. W., a lady about fifty years of age, had for four years been suffering the most excruciating torture from neuralgia, which attacked the branches of the suborbital nerve. The paroxysms were periodical and perfectly regular. They occurred invariably at the hour when the family usually took tea, and it frequently happened that she could not remain at the table on account of the severity of the pain. It rarely occurred at any other period with any considerable violence, but occasionally in case of indisposition or of sudden mental excitement, it would come on at any other time ; this, however, never interfered with its regular recurrence at the stated period which I have mentioned. The first attack of the disease had been produced by extreme mental agitation arising from the sudden death of a dear friend. When I first saw her, she had been under the care of her medical attendant, who had administered large quantities of the carbonate of iron without any advantage. The state of the stomach and bowels had not been sufficiently attended to. The tongue was considerably furred, the bowels habitually constipated, and the appetite uncertain.

As the attacks were so regularly periodical, and as my patient was naturally of a tranquil and cheerful disposition, I could not but hope for a favorable termination of the case. The first step which was taken was to regulate the

state of the bowels, for which the following mild formula was found sufficient :—

R Pil. Hydrarg.

Extr. Hyoscyami ā gr. ij.

Extr. Colocynth. Comp. gr. iv. M. fiat massa, in Pilulas duas dividenda, alternâ nocte sumend.

After a few days I ordered the sulphate of quinine to be taken in doses of three grains, three times in the day, and as it was essential to keep the mind as tranquil as possible, and to prevent it from musing upon subjects of a depressing nature, a short tour, in company with part of her family, was resolved upon. The remedies above mentioned were continued with great regularity and with the most complete success. In the course of three months the complaint was entirely removed, and has not since returned.

I have, however, met with cases in which the remedies I have already mentioned were unsuccessfully employed; and in which after these had failed, a preparation of arsenic was administered with the most marked advantage. As I have already alluded to my own case, and as, after thirteen years of torture, I was cured by the remedy in question, I shall take leave to give a short history of its progress and cure :

It was, to the best of my recollection, in the spring of the year 1812, that I was attacked when walking, with a most acute and severe pain in the left heel, about the spot of the inser-

tion of the plantaris muscle. It was of a fluttering character, with sudden and repeated flashes of a more acute kind, which were but momentary in their duration. This first attack remained about a quarter of an hour, and then wholly disappeared. It recurred however, at intervals, with more or less regularity, until at length it assumed a more perfect intermittent character, the paroxysms returning every evening; and this occurred with little variation during the whole period of its continuance. During the paroxysms the skin was somewhat redder than usual, and a little swollen; and the surface was excessively irritable, especially when lightly touched. At all other times, however, it was perfectly healthy, and did not at all interfere with the action of walking, nor did previous violent exercise appear to increase the severity of the pain. The duration of the attacks varied from a fortnight to three months; during which periods an evening seldom passed without several hours of absolute torture, and the intervals also varied in a similar manner; I have repeatedly passed two or three months without pain, and on one occasion it did not return for more than a year. It was invariably brought on by the occurrence of any source of mental agitation or depression; and continued a longer or shorter time, according to the degree or duration of such exciting cause. The local remedies which I had recourse to were leeches, perpetual blisters, electricity, belladonna plasters, and a multitude of others, all equally useless. The only thing which gave me even temporary relief, was

plunging my heel into the coldest water that could be procured; this relieved the pain as long as the part continued cold, but as soon as it became warm again, the pain returned with the same violence as before. I had recourse at different times, to various remedies directed to the constitution: cinchona in powder, carbonate of iron, sulphate of quinine, &c., were all freely and fully tried, and all without success; at length, at the commencement of a rather violent attack in 1826, I was induced, at the earnest instigation of my friend, Mr. Leese, to try the arsenical solution. The agony which I suffered, led me to take larger doses than my kind friend advised, and than, perhaps, would generally be advisable, at least at the commencement. I took eight drops three times a day, for about a week, at which time the stomach became excessively irritable, the whole nervous system was in a state of morbid excitement—I was obliged at once to discontinue the medicine, and to go into the country; but the disease was cured, and to the present hour I have had no return.

This is not the only case, within my own practice, in which the arsenical solution has been attended with success; but in consequence of the injurious effect which this medicine often produces on the stomach, and on the nervous system in general, I should certainly never have recourse to it until the other remedies which have been recommended had been tried, and repeatedly tried without avail.

OF LOCAL NEURALGIA.

The cases which I have already given, in the course of the work, of painful affections produced by local irritating causes, such as the pressure of a portion of gold upon the nerve of a tooth which had been filled—or of exostosis at the extremity of the root—will at once illustrate the interest which this disorder possesses in relation to the diseases of the teeth. In addition to these, I have to add some others of a similar kind, which equally bear upon the subject in hand, and prove how remotely the effects are sometimes felt of the most simple and apparently trifling causes. The two following are of this character.

In May, 1827, Mr. D., a gentleman about fifty years of age, applied to me in consequence of severe pain occurring in irregular paroxysms, first attacking the ear, and from thence darting down the neck and shoulder, and through the whole length of the arm, so as considerably to diminish the power of the hands and fingers. He had been for more than a year the subject of this affection; and had latterly, consulted a physician of the highest character, who finding that the medical treatment which he recommended had failed to produce the slightest relief, requested me to see him. I was informed that the second inferior molar tooth had been broken about two years before, in an attempt to extract it, and the roots were now remaining in the jaw; the anterior one having been par-

tially thrust out of the alveolus, and lying obliquely upon the gum, the posterior still remaining firmly fixed, but evidently producing considerable irritation in the surrounding parts, with increased pain on pressure, which in some degree assumed the character of those paroxysms which he had so long been suffering. I therefore removed both the roots, and had the satisfaction of hearing, some time afterwards, that the complaint had entirely ceased.

A French gentleman about nineteen years of age, of a florid complexion and of remarkably healthy appearance, consulted me under the following circumstances. He had been for some time affected with a slight degree of loss of power in the right arm, with occasional pain, of that peculiar tingling kind, which is produced by pressure upon a nerve. At length he observed, that an accession of one of these attacks was accompanied with an acute shooting pain in the second molar tooth in the lower jaw on the same side. This led to a more attentive observation of subsequent recurrences of the pain, and he found that, whenever the tooth was pressed or irritated, the sensation in the arm returned. On examining the tooth, I touched the interior of it with a pointed instrument, and produced an immediate return of this affection. Under these circumstances I could not hesitate to extract the tooth, which permanently,

though not immediately, removed the complaint.

Whatever may be the local cause which produces the pain in these cases, the paroxysms will still be found to recur at *irregular* intervals.* Such is expressly stated to have been the case, in

* It would not be difficult to accumulate numerous cases of this description, all of them affording additional evidence of the principle which I have endeavored to support ; but it is, I think, unnecessary to multiply instances. The following case, however, for which I am indebted to my friend John Morgan, Esq., Surgeon to Guy's Hospital, appears to me to illustrate so well the distinctive characters of local neuralgia, and is in itself so interesting, that I do not hesitate to insert it, although the seat of the disease is in an organ remote from those which more particularly belong to the present essay. Its interest is greatly enhanced by the circumstance that the exciting cause of the pain was temporarily removable, at the will of the patient, and that such removal was invariably productive of instantaneous relief. I give the case in Mr. Morgan's own words—

“DEAR BELL,

“The following are the particulars of a case of Neuralgia, the general symptoms of which I have already mentioned to you.

“The subject of the disease, by trade a tailor, of apparently sound constitution, and between fifty and sixty years of age, was placed under my care as a patient in Guy's Hospital, in the month of May last.—He was at that time suffering from the effects of entropion in both eyes. In the left eye the disease was producing but trivial inconvenience, whilst in that on the right side, the suffering was extremely severe, and of an unusual character. The account which he gave of the commencement and progress of his complaint was as follows :

“About six years ago, after a severe attack of ophthalmia, which was accompanied by a very considerable swelling of the lids, the tarsi became inverted. In consequence of this, the distressing symptoms usually met with in cases of entropion supervened. For the relief of these symptoms he placed himself at different periods under medical treatment, but without

the instance related by Mr. Abernethy, in which the disease occurred in the finger. It appears

receiving any permanent benefit from the remedies which were made use of. The formation of a slough by the application of caustic to the under part of the lower lid, and the subsequent excision of a portion of the orbicularis palpebræ, were operations to which he submitted without experiencing any beneficial result.

“Until within the last two years, the symptoms which he describes, are simply those of severe entropion; but about this period a peculiar neuralgic affection was added to his other sufferings, which constitutes the principal point of interest in the case; it consisted, to use his own expression, in a ‘ticking, flickering, darting pain,’ which occurred occasionally during the day, and was constant when in the recumbent posture. This pain was altogether different from any which he had ever experienced before, and extended from the lower lid and globe of the eye on the right side, over the forehead, right temple, along the lower jaw, down the side of the neck and arm, to the right elbow, and occasionally also as far as the wrist.

“These occasional neuralgic affections were existing in the highest degree of severity at the time he placed himself under my care; and, at this period the cornea of the right eye was rendered partially opaque and highly vascular, by the constant pressure of the inverted lid; there was severe conjunctival inflammation, and the intolerance of light was excessive.

The inversion of both lids of the right eye was considerable, the lower lid being somewhat more inverted than the upper; and the connexion between the entropion of this part and the singular nervous affection which I have mentioned, was clearly proved by the circumstance, that even in the most severe paroxysm of pain, a separation of the lower lid from the globe produced at all times a temporary and instant relief.

It appeared to me, therefore, that the removal of the cause of his sufferings might be effected by the excision of that portion of the cartilage of the lower lid, which, by its pressure, was keeping up, if not producing morbid excitement in the nervous system. I therefore removed about two-thirds of the inferior tarsal cartilage, by cutting out a triangular central portion of the lid. The result of this operation, however, disappointed my expectations; for although temporary relief was afforded, yet the remaining portions of the tarsus were found, after the

that, in some cases, the branches of the nerve are themselves the seat of the complaint, and it is not improbable that a degree of inflammation may thus exist, either in the nerve itself or in the sheath. It was doubtless by some such cause, that the two following cases were occasioned, in which the external application of a very powerful counter-irritant was eminently beneficial.

Mr. G. consulted me some years since for a most severe attack of neuralgia of the branches of the superior and inferior maxillary nerves. The paroxysms were not characterized by any periodical exacerbation, but scarcely five minutes in the day passed without an attack of pain, and that of the most excruciating kind, so

healing process had been completed, to produce the former train of symptoms, in consequence of their contact with the globe. I then removed, by excision, the whole of the inferior tarsal cartilage, and produced for a time a complete alleviation of his neuralgic complaint. In the course of about six weeks, however, the disease returned with its former severity, and was now referred to the inverted condition of the upper lid; for the paroxysms were invariably and instantly stopped by a separation of the superior tarsus from the eye-ball. The tarsal cartilage of the upper lid was therefore dissected completely out; and the operation which was performed about six months ago, has hitherto been attended with complete success as regards the removal of neuralgic affection. I should also mention, that soon after his first admission into the Hospital, the extension of pain along the lower jaw during the paroxysms, was entirely prevented from recurring, by the extraction of three carious molar teeth on the same side.—At present, the man is suffering from chronic ophthalmia in the right eye, and from entropion in the left. Previous to the excision of the tarsi, the constitutional remedies which are occasionally found beneficial in cases of tic douloureux were tried without avail.

“Yours, ever most sincerely,

“JOHN MORGAN.”

as suddenly to arrest his speech, and to throw the superficial muscles of that side of the face, into the most violent contortions. Bark had been administered in large quantities, as well as various other remedies, including belladonna and other narcotics, and various purgatives, but without the slightest relief. I ordered the following preparation to be applied to the face :

R Hydrarg. Oxymur. ℥i.
Unguent. Cetac. ℥i. Misce, fiat linimentum.

The whole side of the face was rubbed with this for three successive nights ; after which it became completely covered with one continuous scab, which was suffered to come off spontaneously, leaving a new cuticle, over which the ointment was again applied ; and this was repeated four or five times. Although the pain was not wholly removed by this plan, yet it was so much diminished as to enable Mr. G. again to enjoy the society of his friends, from which he had long been wholly debarred.

In the other case in which I employed this remedy, it was still more successful. But the temporary effect is so frightful that few persons, I believe, would be disposed to repeat its application sufficiently often.

L. B., a waiter at an inn, was the subject of neuralgia in the branches of the suborbital nerve, to so severe a degree as at length to incapacitate him for his situation. After trying in vain the constitutional remedies usually employ-

ed at the period, (it was before the carbonate of iron had been brought into use,) I resolved upon the preparation of the oxymuriate of mercury, mentioned in the former case. The immediate effect of its application was the same, but I had only occasion to order its repetition three times, when the pain had wholly ceased. It recurred a month afterwards in a much more moderate degree ; and was finally cured by the application of the same ointment for three successive nights.

Nothing is more common than for attacks of pain of the most excruciating kind—so nearly resembling *tic douloureux*, as not to be distinguished from it but by the irregular recurrence of the paroxysms, upon which I have so repeatedly dwelt—to be produced by the exposed nerve of a tooth, by the pressure of dental exostosis, or even by the irritation excited in the socket by a dead extraneous root. That these cases have very frequently been confounded with true *tic douloureux*, and ineffectually treated as such, in consequence of a disregard of the distinction which I have mentioned, I have seen numerous proofs ; and it is therefore with the greater confidence that I venture to dwell upon the opinion now advanced. But there are other cases in which more severe local disease appears to have been the cause of the pain, which required greater caution and hesitation in assigning them distinctly to this form of the disease, but on which mature consideration has led me to form a similar decision. I mean those cases which have of late excited considerable interest in the profession, where a thickening of the inner table of

the skull, by means of an amygdaloidal deposit of bone, has been found in persons who have died when suffering under the complaint in question. I have not yet had an opportunity of observing the symptoms of such a case, in accordance with the view which I am now taking of the subject; but I have every reason to believe, from the imperfect history which I have obtained of one or two similar instances, that a farther knowledge of them will be found to confirm my opinion. In a case which is at this time under my care, I cannot but fear that such a formation has taken place, from the peculiar deep-seated pain in the head, which has lately increased to a considerable degree, and which the usual constitutional remedies have failed permanently to relieve. The partial and temporary relief which is afforded by leeches, by the shower bath, and by the application of cold lotions, is consistent with, if not in some degree confirmatory of this view of the case.

It is however true that the remedies which are recommended in constitutional neuralgia, are often beneficial to a considerable extent in that which arises from a local cause. I have frequently administered the sulphate of quinine, and the arsenical solution, with great mitigation of the patient's sufferings, and in some cases their total, though but temporary cessation. Such has more than once been the effect of these medicines in the case just mentioned; but as the paroxysms have always been irregular, I fear that no permanent cure is to be anticipated. The following is a detail of the case:—

When I first saw the lady to whom I now

refer, I was of opinion, from the history of the case, that the cause was local. The paroxysms of pain were extremely frequent and severe, and she had been suffering so long as to have become very much reduced. On making the most minute inquiry, and even after directing the patient's particular attention to the question for some days, I could not find that any thing like a periodical exacerbation of the disorder was perceptible. I therefore removed immediately several diseased teeth, which I thought might be the cause of the complaint; but the relief thus procured, though considerable, was but temporary. I then ordered the sulphate of quinine to be taken in doses of three grains three times in the day, leeches to be applied to the cheek and forehead, and a cold lotion to the whole side of the face. This plan was successful in affording almost entire relief for several weeks, but after this time the pain recurred with even greater violence. The same means were resorted to with the addition of the shower-bath, with but partial success; and at the present time the disorder is still increasing, with the addition of a dull, deep-seated aching pain in the head, which leeches and cold applications have, however, at times partially relieved.

To conclude.—In offering the foregoing remarks to the consideration of the profession, I wish to be understood rather as submitting a few practical hints, the value of which can only be ascertained by future and much more extensive observations, than as aiming at the support of a theory, or the assertion of a mere dogma. I have not

hastily adopted the views which I have thus cursorily exposed ; but should the ultimate establishment of more correct opinions on the nature of these most distressing affections, and the adoption of a more successful practice in their treatment, arise but in the slightest degree from the consideration and discussion of the opinions which I have advanced, my object will be accomplished. and I shall be equally satisfied with such a result, whether the doctrine itself be refuted or confirmed.

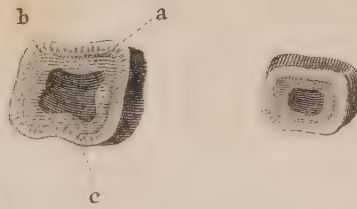
THE END.



1



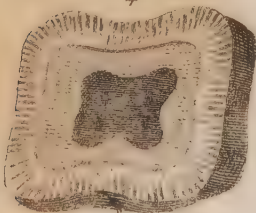
2



3



4



5



PLATE I.

Fig. 1. Views of different kinds of teeth, showing their anatomical division into the body or crown, *a a*; the fang or root, *b b*; and the neck, *c c*.

Fig. 2. Sections of teeth, exhibiting their structure: *a a*, the bony substance; *b b*, the enamel; *c c*, the internal cavity; *d d*, the foramen at the extremity of the root.

Fig. 3, 4. Magnified sections to illustrate the arrangement of the fibrous crystals composing the enamel.

Fig. 5, a. A small fragment of the grinding tooth of the Asiatic elephant, showing the structure of the enamel; *b*, the same enlarged.



PLATE II.

Front and lateral views of the different classes of the teeth in the adult.

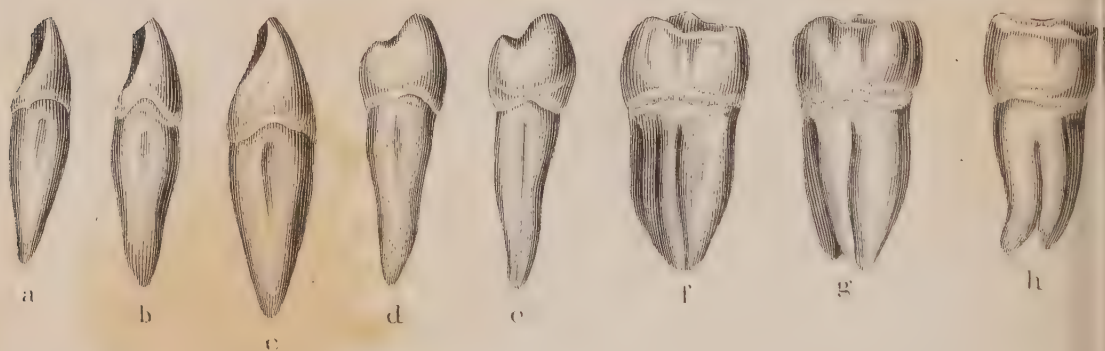
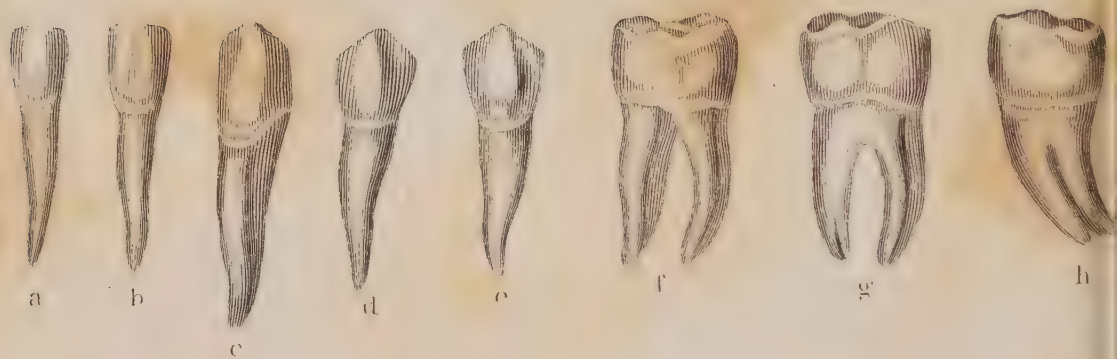
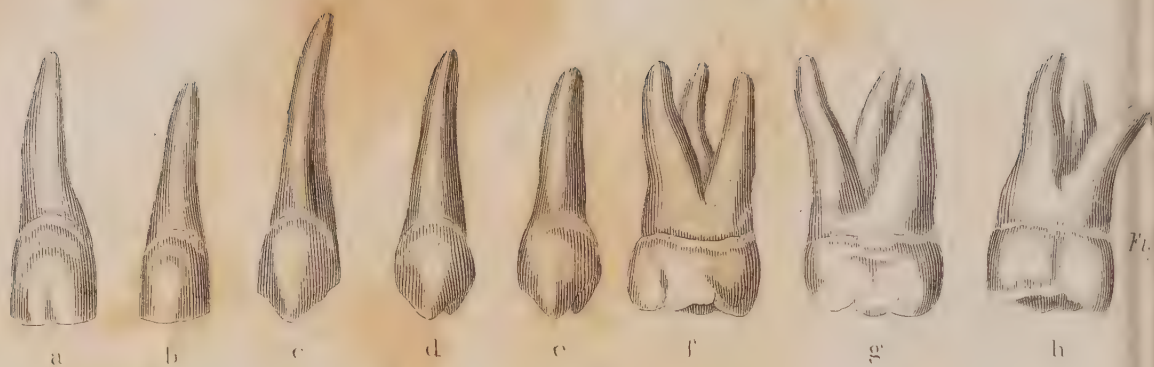
Fig. 1. Front or external view of the upper teeth.

Fig. 2. Lateral view of the same.

Fig. 3. Front view of the lower teeth.

Fig. 4. Lateral view of the same.

In each of these series, the letter *a* indicates the central incisor ; *b*, the lateral incisor ; *c*, the cuspidatus ; *d*, the first bicuspid ; *e*, the second bicuspid ; *f*, the first molaris ; *g*, the second molaris ; and *h*, the third molaris, or *dens sapientiæ*.



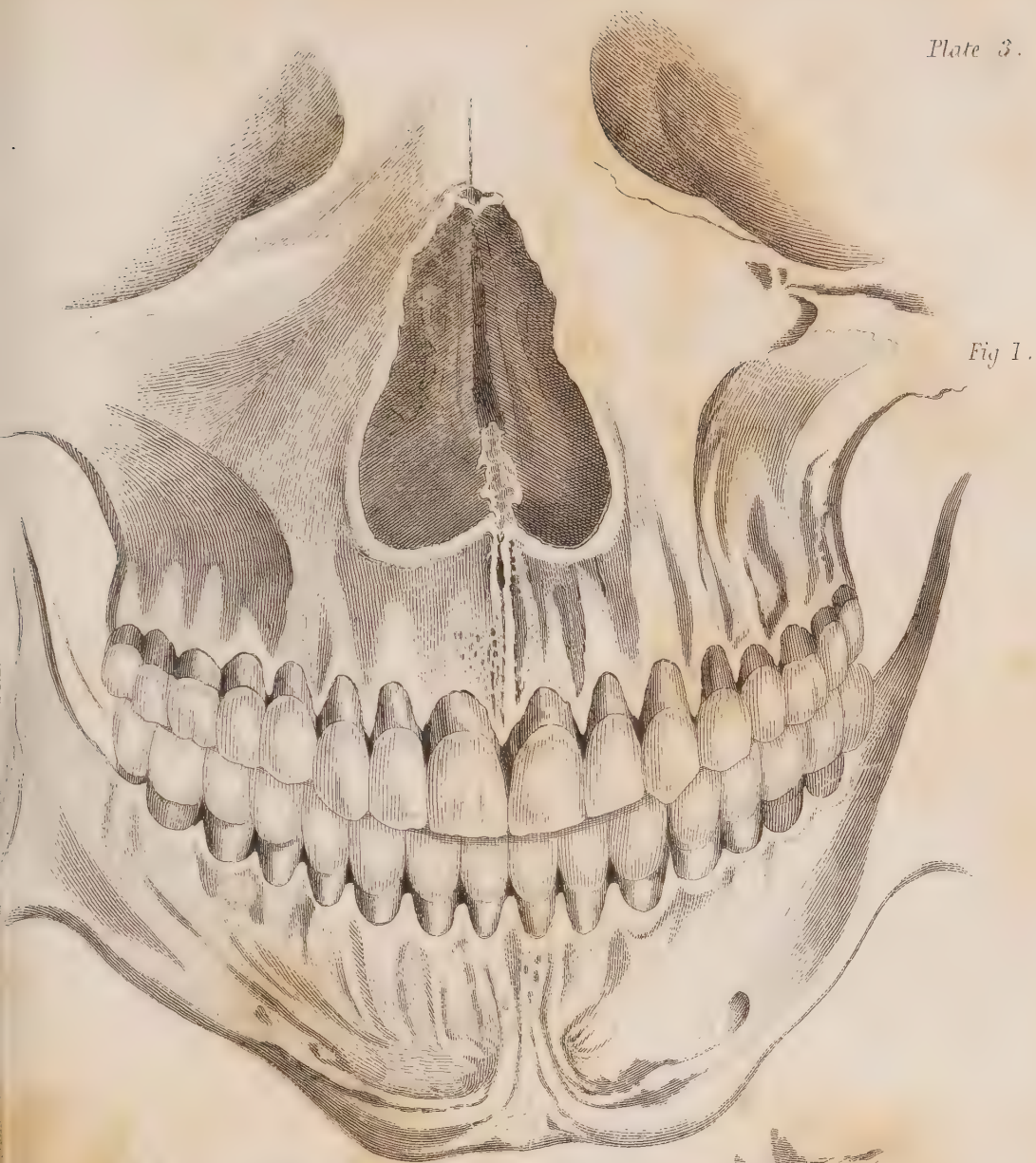


Fig 1.

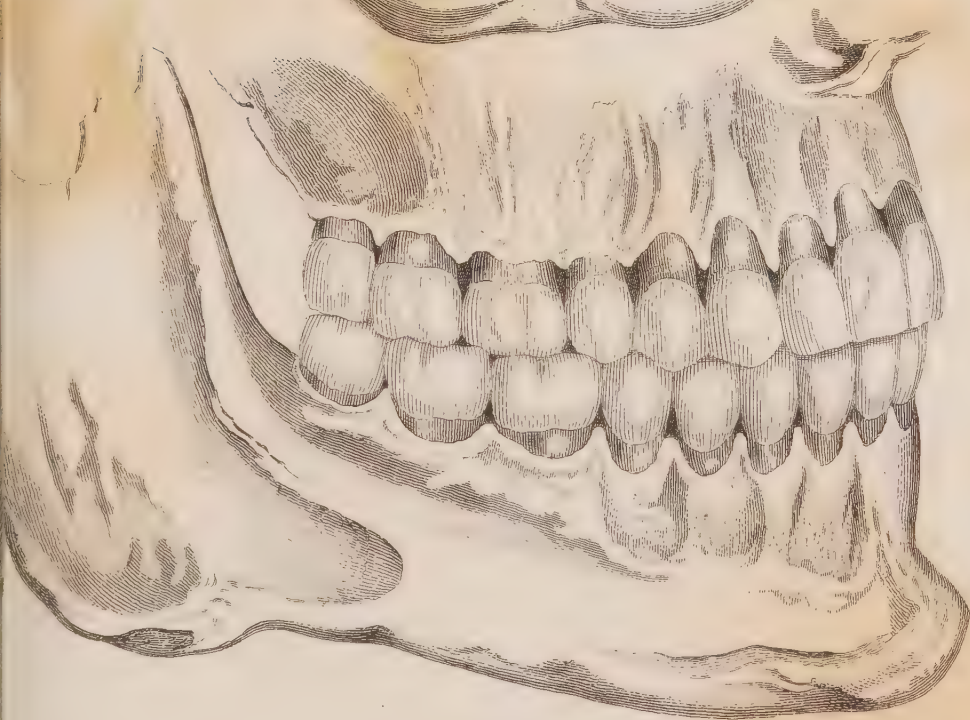


Fig. 2.

PLATE III.

Fig. 1. A front view of the whole series of the teeth, *in situ*, showing the relative situation of those of the upper with those of the lower jaw.

Fig. 2. A lateral view of the same.



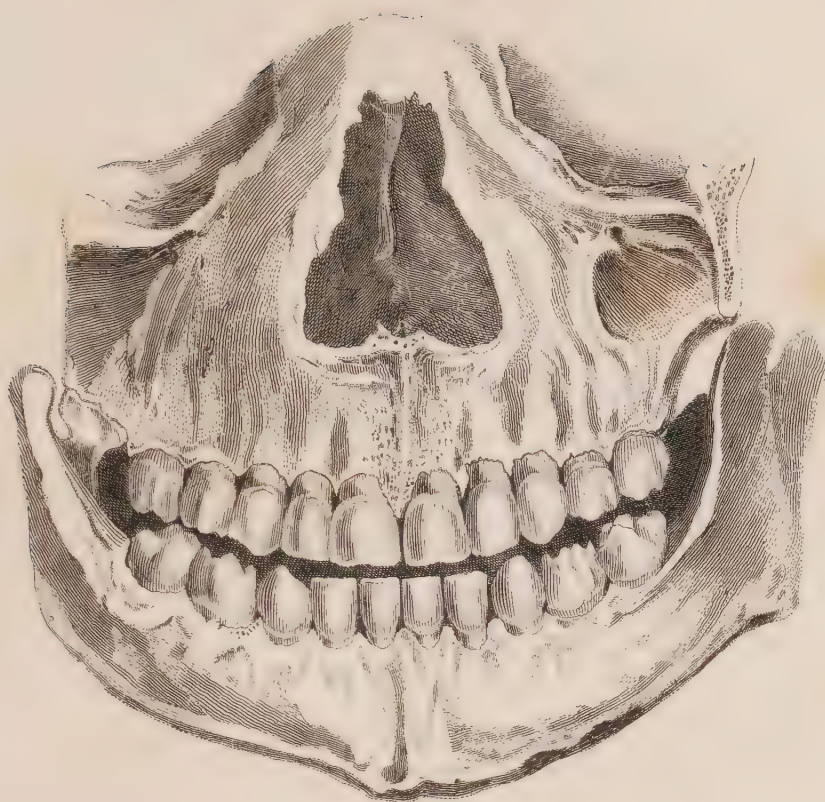
PLATE IV.

Fig. 1. A front view of the temporary teeth complete, *in situ*.

Fig. 2. The separate temporary teeth of each jaw :
a, the central incisor ; *b*, the lateral incisor ;
c, the cuspidatus ; *d*, the first molaris ; *e*, the
second molaris.



1



2

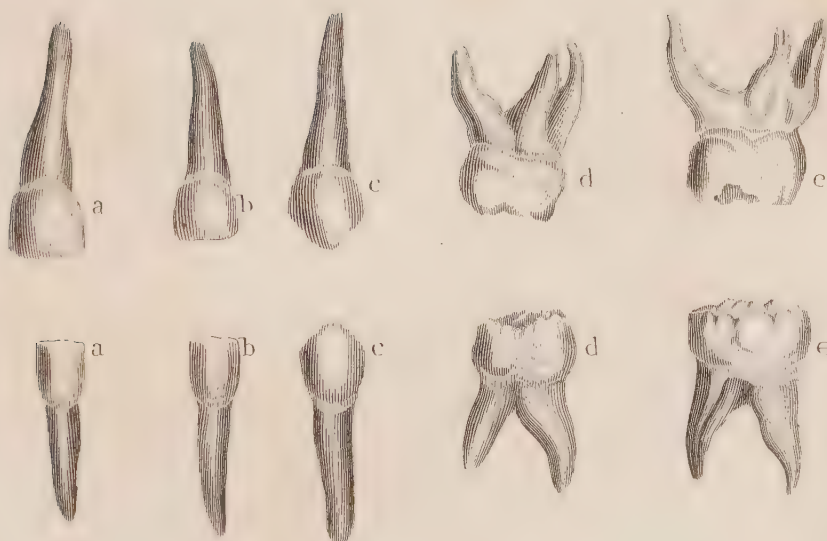


Fig. 1.



PLATE V.

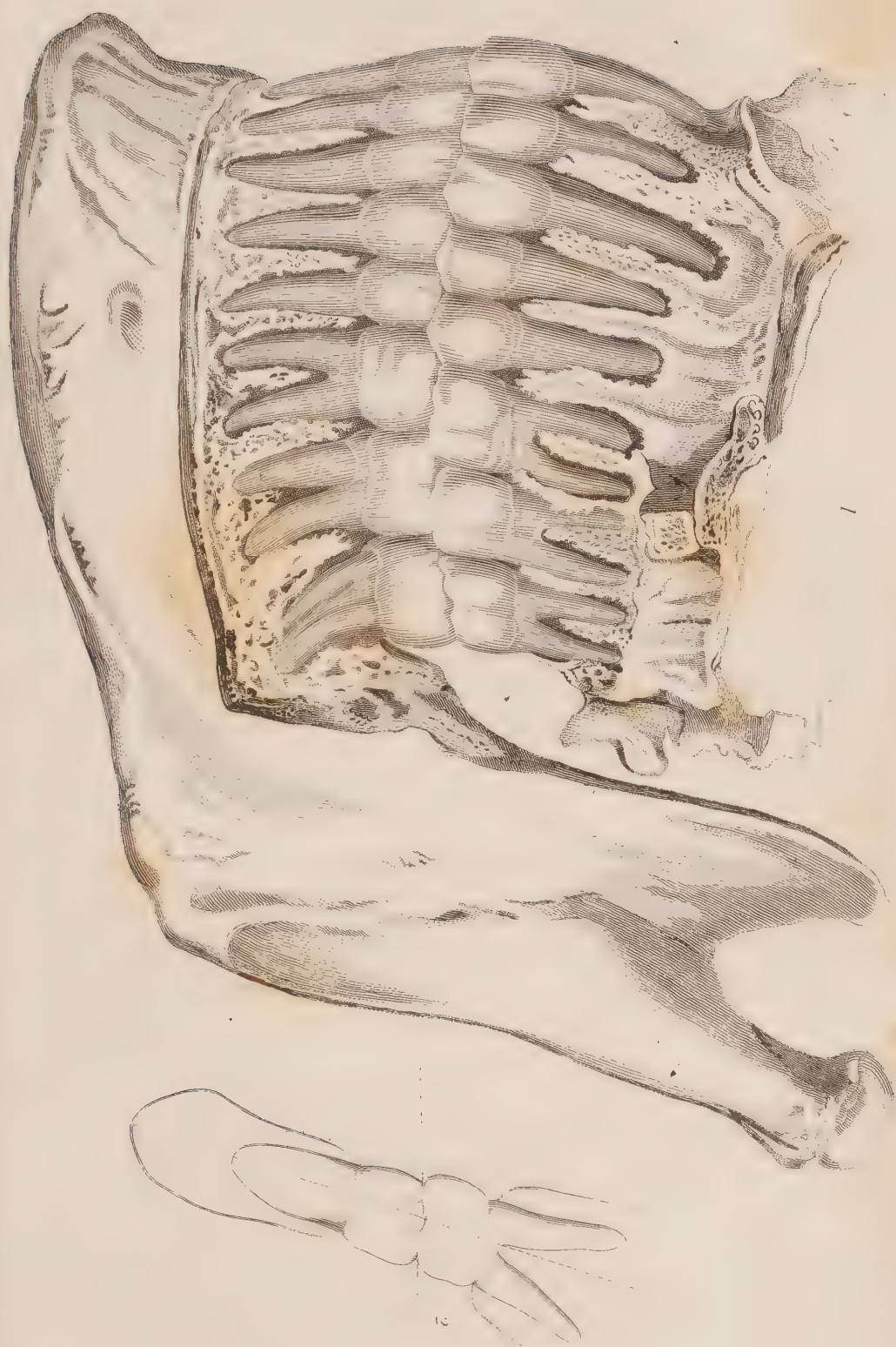
Fig. 1, 2. The adult upper and lower maxillary bones, the teeth being removed to show the alveoli.

PLATE VI.

Fig. 1. A view of the upper and lower teeth in the alveoli; the external alveolar plate being cut away to show their articulation.

Fig. 2. A diagram, showing that the relative position of the upper and lower molares corresponds with the direction in which they meet in mastication.





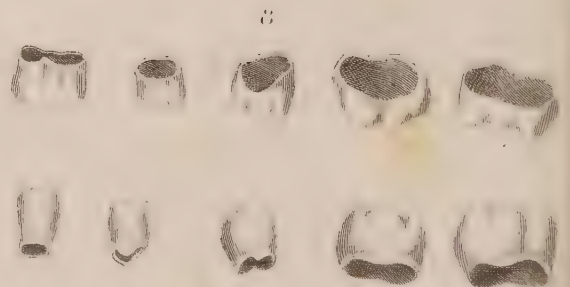
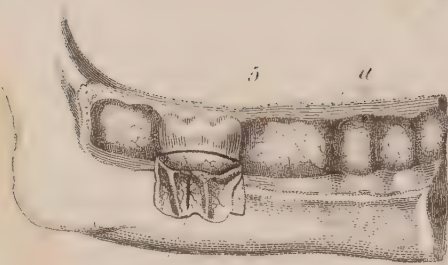
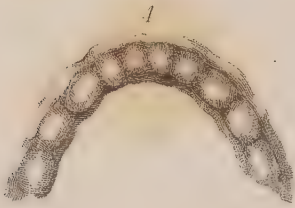


PLATE VII.

Fig. 1, 2. The upper and lower maxillary bones in a foetus, between the third and fourth month.

Fig. 3, 4. The corresponding rudiments of the temporary teeth.

Fig. 5, 6. The external and internal laminæ of the investing sac, showing the vascularity of both ; *a*, the external layer ; *b*, the internal.

Fig. 7. The bony shells of the temporary set, removed from the pulps, in a foetus of six months.

Fig. 8. The same at birth.

Fig. 9. Consecutive specimens, showing the manner in which the roots are formed.

PLATE VIII.

Fig. 1. The production of the permanent rudiment by means of a process given off from the temporary, shown in a lower incisor.

Fig. 2. The same fact in a molaris.

Fig. 3. The rudiments in a more advanced stage; the permanent being now enclosed in its proper socket, though still connected with the temporary.

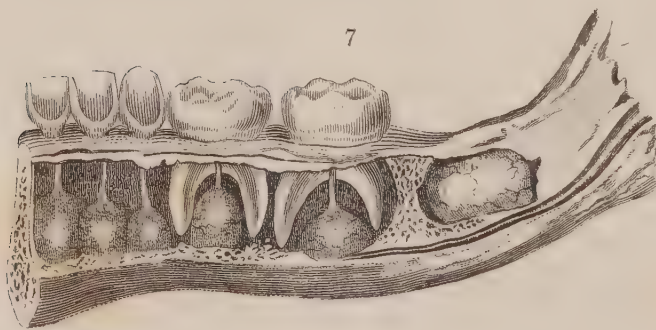
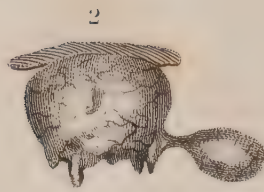
Fig. 4. The connexion between the temporary tooth and the permanent rudiment, as it exists after the former has passed through the gum.

Fig. 5. The corresponding alveolar cavities, from which the temporary tooth and the permanent rudiment have been removed.

Fig. 6, 7. Views of the upper and lower jaws after the whole of the temporary teeth have passed through the gum, showing the relative position of the temporary teeth and the rudiments of the permanent at this period.

Fig. 8. Supernumerary teeth from the fore part of the jaw.

Fig. 9. Supernumerary teeth from the back part of the jaw.



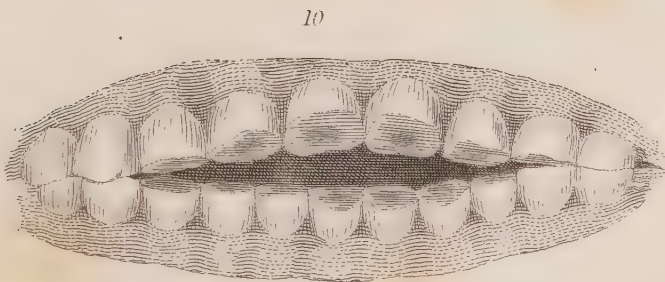
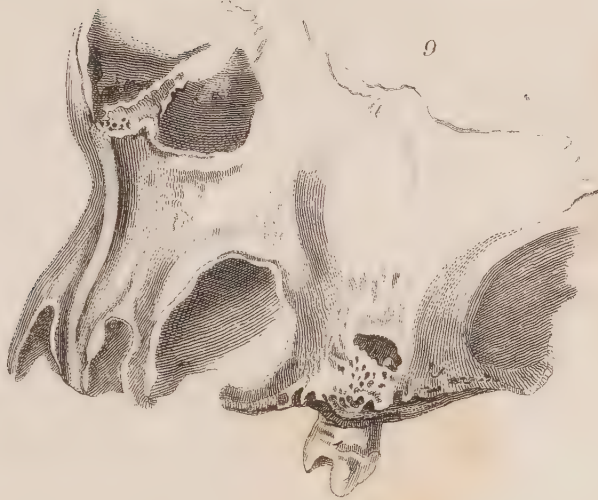


PLATE IX.

Fig. 1, 2. Sections of teeth, showing the commencement of gangrene.

Fig. 3. A circular portion of the neck of a *dens sapientiæ*, remaining after the destruction of the crown by gangrene, and of the root by absorption.

Fig. 4. Section of a tooth which had been the subject of abscess in its bony structure.

Fig. 5. Fungous growth of the internal pulp.

Fig. 6. Deposition of lymph around the root of a tooth in consequence of inflammation; constituting the first step towards the formation of alveolar abscess.

Fig. 7, 8. Different forms of the sacs in alveolar abscess.

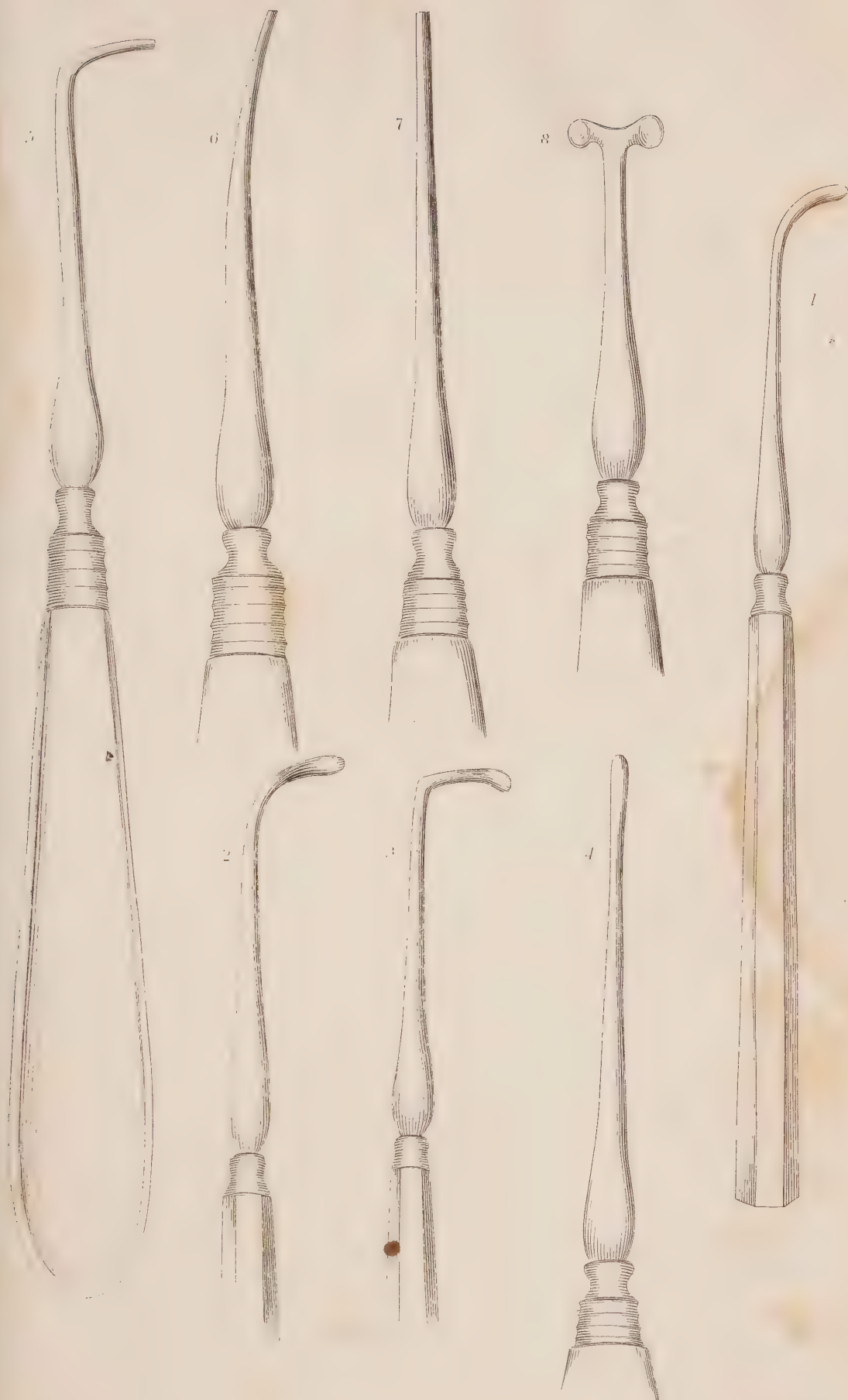
Fig. 9. The effect of alveolar abscess in producing absorption of the alveolar process; taken from a specimen in the museum of Guy's Hospital.

Fig. 10. Singular case of the spontaneous and gradual truncation of the fore teeth of the upper and lower jaws. The detail will be found at page 188.

PLATE X.

Fig. 1, 2, 3, 4. Instruments used for cutting away decayed portions of teeth, previous to filling the cavity with metal.

Fig. 5, 6, 7, 8. Some of the instruments employed in filling the cavities produced by gangrene.



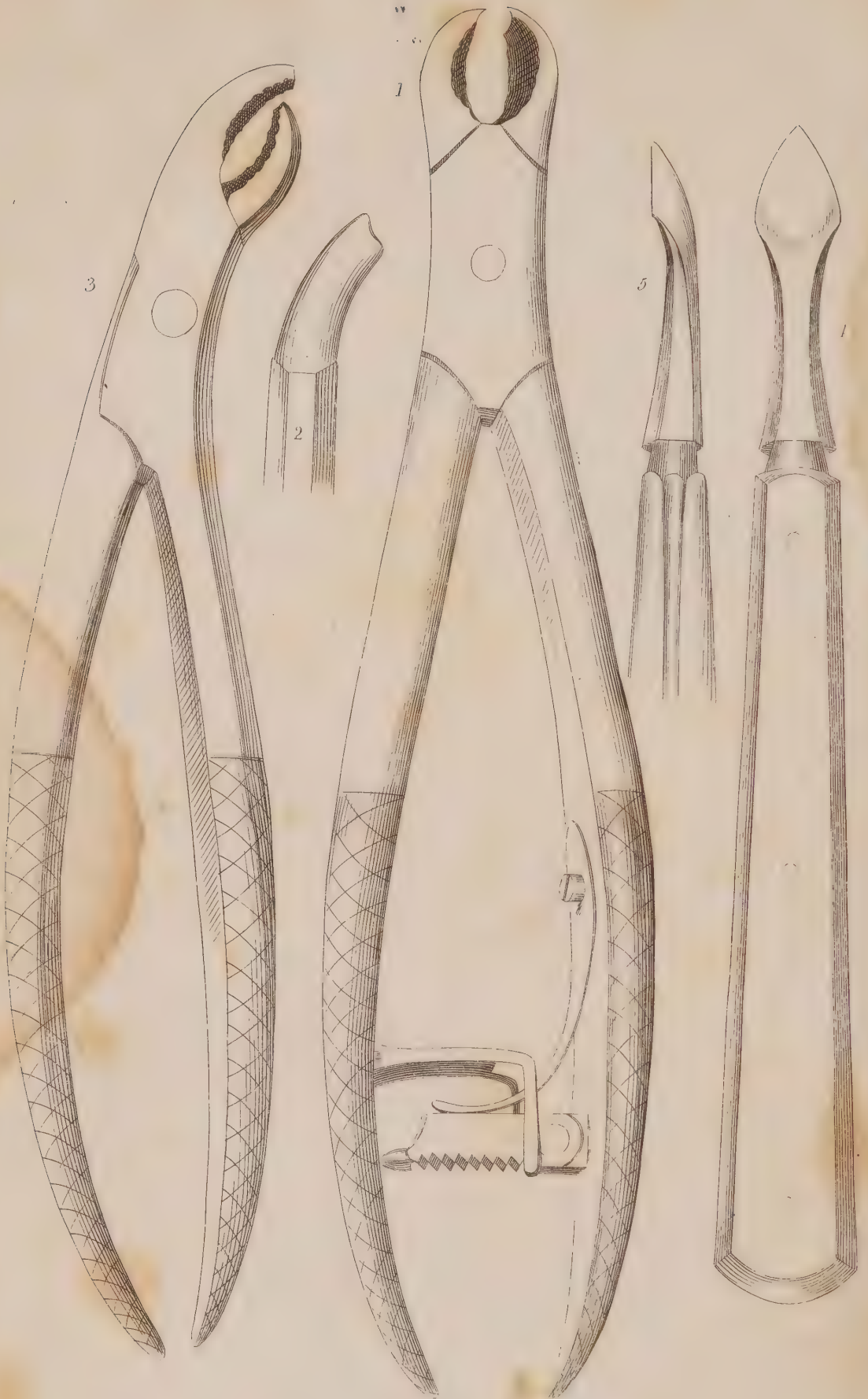


PLATE XI.

Fig. 1. Forceps adapted for the removal of the superior molares, with the addition of a rack-work, attached to the handles, to prevent the instrument from slipping upon the tooth.

Fig. 2. Lateral view of the blades of this instrument.

Fig. 3. The "hawk's-bill" forceps, for the extraction of the inferior molares.

Fig. 4, 5. The elevator.





